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A New Alternate Current Dynamo.

Messrs. Mather & Platt, of the Salford Iron Works, Manchester, are now manufacturing an alternate current dynamo, which embodies several new features, and has given very satisfactory results in practice. As is the case with most alternate current machines in which the armature contains iron cores, the armature revolves and the magnets are fixed. The magnets are of wrought iron, and are arranged round the armature, exterior to it, and are attached to a massive cast iron ring which forms the yoke connecting the limbs. The attachment is so arranged that any of the magnet cores can be removed without disturbing the remainder, or taking out the armature. The armature is constructed of two plates or disks keyed on the shaft, between which the armature cores are held by bolts. As with the magnets, any section of the armature can be removed without disturbing the remainder. Apertures in the disks allow free ventilation of the armature cores.

The magnets are excited by a Mather & Platt's "Manchester" dynamo, which is carried on a bracket bolted to the bed-plate of the alternator, the armature shafts being coupled direct. The whole arrangement is exceedingly compact, occupying little floor space. The machines are manufactured under the patents of Dr. John Hopkinson and Dr. Edward Hopkinson, and are made in several standard sizes up to 100 Board of Trade units. For working with transformers they are constructed either for 1,000 or 2,000 volts, and from 8,000 to 12,000 alternations per minute, or with a "periodicity" of from 66 to 100. The machines can be run in parallel perfectly, and may be thrown into parallel working without the least danger, even when there is considerable difference between the electro-motive forces at the terminals or when the machines are running at different speeds.

The machine illustrated gives an output of 1,000 volts and 30 amperes, at 800 revolutions per minute. The armature resistance is 0.55 ohms, and the resistance of the magnets two ohms. When working with full load the current through the magnetic coils is 21 amperes, showing an electrical efficiency of over 95 per cent. Messrs. Mather & Platt have already constructed several of these machines for central station work, and have a number now in course of construction. The above facts we learn from *Industries*, our esteemed London contemporary.

The Kansas City Electric Light Convention.

All who propose attending the Electric Light Convention at Kansas City and have not yet secured accommodations on the special "Electric Limited," which will leave the Pennsylvania Railroad station, Jersey City, on Sunday morning next, February 9, at 9.45, should communicate at once with Mr. C. E. Stump, chairman New York transportation committee, *Times* building, New York. The fare going, including sleeper, is $39.75.

The transportation committee will be at the Electric Club on Saturday, February 8, from five to ten P. M., to furnish tickets and berths to those who are not able to secure them before that time.

The State Electric Light Association.

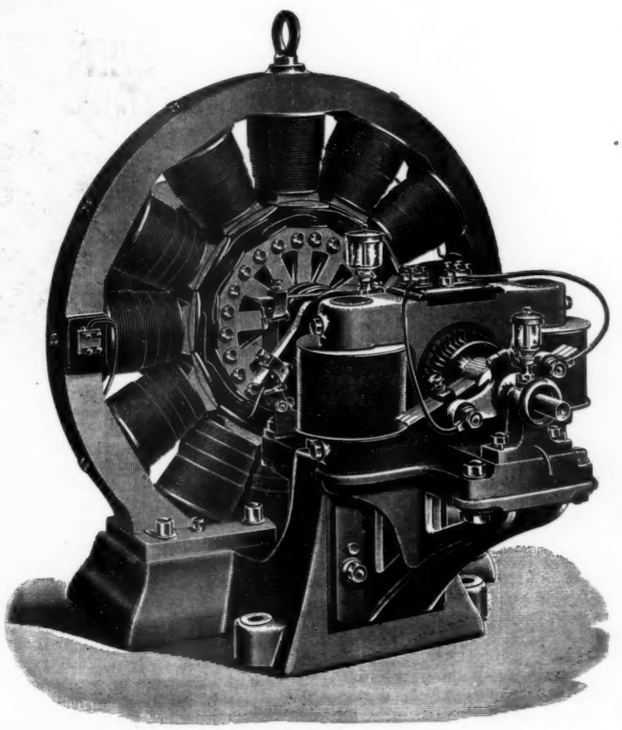
The electric lighting companies of the State of New York have organized a State Association. The meeting was held in Albany recently, and the following officers were elected:

President, Thos. F. Nevins, Brooklyn.

First vice-president, C. R. Huntley, Buffalo; second vice-president, W. H. Browne, New York.

Secretary and treasurer, E. A. Maher, Albany.

Executive committee: T. F. Nevins, Brooklyn; C. R. Huntley, Buffalo; W. H. Browne, New York; E. A. Maher, Albany; B. B. Odell, Newburgh; J. G. Moore, New York; F. A. Cheney, Elmira; A. B. Smith, Poughkeepsie; Geo. A. Redman, Rochester.



THE MATHER & PLATT ALTERNATING CURRENT DYNAMO.

Testing Electric Motors for Traction.

A novel test of the strength of the electric motors in use on the West End street car system was made last week. Three ordinary passenger cars were hooked together, two of them being loaded to the ceiling with bags of meal, huge coils of heavy rope and other compact and weighty articles. The combined weight for each car was estimated at 10,000 pounds. The chief interest of the test centered upon the steep grades at Chardon and Cambridge streets, near Bowdoin square. After the tracks were well sanded, the heavily laden "train" was started, and the Cambridge street grade was easily conquered, as was subsequently the Chardon street grade.

Electric Lighting in Austria.

The electric lighting of Vienna progresses very slowly, says *Industries*, and it meets with a great deal of influential opposition in all quarters. For instance, the project of the central station at Neubad, from which 60,000 lamps were to be supplied, has been before the public for six years, but up to the present time M. Fischer and Siemens & Halske have only been able to complete sufficient plant to feed 5,000 lamps. The project of Professor Engländer has not fared any better. It took him three years to persuade the authorities, and the public in general, as to the advantages of having a central station in Copernicus-Gasse. At present 12,000 glow lamps are being supplied from the station by means of five vertical high pressure steam engines and ten dynamos of various types. Accumulators are employed to equalize the day and night duties of the machinery. The whole installation is erected on very good lines, and it supplies a large number of important buildings. The International Electricitäts Gesellschaft are pushing on their central station. During the past year Messrs. Ganz & Company have brought out an alternating current motor, a watt-meter, a new transformer for their high power watt-meter, and an electric railway.

Telegraphic Tournament.

Under the management of Mr. Fred. Catlin, 195 Broadway, a National Fast Telegraphing Tournament is to come off at an early date, probably in April next. It is expected there will be six prizes in all, and the operators will have some valuable ones to contend for.

Credentials at the Kansas City Convention.

TO THE EDITOR OF ELECTRICAL REVIEW:

DEAR SIR: From the fact that the undersigned is receiving many letters from gentlemen connected with electric lighting central station companies in all parts of the United States, requesting information as to what credentials will be required to obtain the full privileges of active membership at the Kansas City Convention, February 11–14, I desire to say that there is no constitutional provision nor written by-law covering this question.

Any deliberative assembly, composed of individuals representing corporations, undoubtedly has a right to require *any* delegate to prove that he is authorized to represent the corporation under whose name he votes. For this reason, and because of the fact that the coming convention will be attended by a large number of new members, it is very desirable that *every* gentleman, who takes an active part in the convention, bring with him a letter from the central station company under whose name he votes, naming him as its representative.

For the reason that the papers and committee reports to be read at Kansas City, are not only greater in number than at any previous convention, but are of more than ordinary value, treating, as most of them do, with the practical questions which demand an immediate solution at the hands of the electric lighting fraternity, and also on account of the very elaborate and complete exhibit of apparatus by the associate members, it is desirable that everything be done which will facilitate getting the convention quickly into working shape. Nothing will facilitate the work of the convention more than for each delegate to come properly accredited. Very respectfully,

ALLAN V. GARRATT,
Secretary and Treasurer of The National Electric Light Association.

The New Jersey Electric Light Association.

At a meeting of representatives of electric light and power corporations in the State of New Jersey, held at the residence of H. W. Pope, Elizabeth, N. J., January 28, the New Jersey Electric Lighting Association was formed, and following officers elected:

President, H. W. Pope.

First vice-president, J. T. Ridgway; second vice-president, Hon. E. A. Armstrong.

Secretary and acting treasurer, Alex. S. Brown.

Executive committee, H. W. Pope, Elizabeth; J. T. Ridgway, Trenton; Hon. E. A. Armstrong, Camden; Alex. S. Brown, Morristown; D. H. Applegate, Red Bank; S. Lindsley, Orange.

The Aluminum Brass and Bronze Company, of Bridgeport, Conn., keeping pace with the most advanced practice, are installing an Edison plant in their mills.

It is expected that the Capital Electric Light Company will absorb the Nashville Lighting and Power Company. The latter is the older company, and negotiations between the two have been pending some time.

Census Bureau Foote at Work.

One of the principal apartments on the parlor floor of the Russell House, recently, was not altogether as hotel chambers usually are, says the Detroit *Free Press*. It had more the appearance of a committee room in connection with some department of state. The tables, chairs, wash-stand, and even the snowy counterpane of the bed, were strewn with all sorts of official looking documents, interspersed with hastily jotted down memoranda in the queerest of all queer looking hieroglyphics. All day long squads and detachments of shrewd looking business men from Detroit, Grand Rapids and other portions of the State, filed slowly in and out of the mysterious department in irregular squadrons. At one time their stay would be of brief duration, at another it was indefinitely protracted. At a small table in the center of the room, where the official documents had accumulated, sat a shrewd looking middle-aged gentlemen. He was exceedingly restless of eye and quick and nervous of movement. His roving glances comprehended all portions of the apartment at all stages of the proceedings, while a rapid series of technical questions fell from his lips with the velocity of hot shot. His round and ruddy visage was adorned with a brief but emphatic iron-gray mustache, while the covering of the summit of his intellect was exceedingly scant and abbreviated.

An official card informed all curious observers that this great human center of gravity was Allen R. Foote, of the Census Office, Washington, D. C. It also imparted the supplementary information that Mr. Foote is chairman of the National Committee on State and Municipal Legislation, of the National Electric Light Association; chairman of the Committee on Data, of the National Electric Light Association; special agent of the Eleventh Census of the United States Electrical Industry, and author of the book on "Economic Value of Electric Light and Power." Under the authority conferred by an act of Congress entitled "An act to provide for taking the eleventh and subsequent censuses," approved March 1, 1889, Mr. Foote, then of Cincinnati, O., was appointed special agent of the Census Office, to have complete charge of the collection of statistics of the electrical industry. He is authorized by the Secretary of the Interior, John W. Noble, and Superintendent of Census Robert P. Porter, to conduct in his own name all correspondence relating to this industry, and, under Superintendent Porter's direction, to pursue special inquiries into the condition and tendency of the matters placed in his charge. By previous appointment, he recently met the leading electrical men of Detroit and Michigan at the Russell House for the purpose of obtaining such preliminary information as would enable him to understandingly inaugurate the prosecution of the important mission with which he has been entrusted. His present hurried tour will only include the important cities, although his report will embody the electrical industries of all points of 10,000 inhabitants and over. The detail work will be set on foot at the conclusion of the present preliminary tour.

"Will you furnish some details regarding what is to be accomplished by your bureau?" Mr. Foote was asked last week.

"We expect to accomplish a great deal, both in the interest of the general public and those who are engaged in the electrical business," was the reply. "It is the purpose of the office, without seeking data which may be irrelevant or unimportant, to make the statistics of the industry complete, so that its real condition and true importance may be known and understood by the general public. We confidently believe that those who are to derive the chief benefit from the result of the inquiry—as, for instance, manufacturers and central station companies engaged in the distribution of electric currents for the commercial uses of light and power—will lend their cordial aid to render that result full and reliable. We send out a printed schedule containing a long list of formal questions relating to the immense detail of the business, and expect that they will be promptly and correctly answered. We also solicit beyond this the hearty co-operation of all persons interested in furnishing information promptly and accurately in the procurement of additional facts and in the suggestion of pertinent and useful lines of investigation. Without such co-operation, intelligently applied, the inquiry must of necessity be limited in its value."

"Will such information be treated by you as strictly confidential?"

"It will. All those who contribute information upon any branch of the subject may rest assured that we will faithfully observe the requirements of law relative to answers to census inquiries. Every employé of the Census Office specifically makes oath not to disclose improperly that which he ascertains, and severe penalties are imposed for any violation of the obligation to secrecy. All persons with whom we have dealings may, therefore, have confidence that their compliance with requests for information as to certain details of their business will in no case be followed, either in my report, or in the tabulation of results, by the disclosure of matters which they properly desire to withhold from publicity."

"In what manner will such a work benefit the general public?"

"I will try to explain. The census of 1880 makes no mention of the industry of generating and distributing from central stations, electric currents for uses of light and power. The investigation of this industry for the eleventh census will be the first official census report made on the subject in this or any other country. For this reason it is particularly desirable and essential that the investigation shall not only present a correct record of the industry as it exists to-day, but that it shall so classify and arrange the information as to render it serviceable as a basis for present action, and of comparison for all future reports. In view of these facts, the importance and value of such an investigation and the official publication of its results, should, in itself, be sufficient to secure from the public a special effort to answer fully and promptly every inquiry. The exhibition of the birth of an industry, and its growth to the magnitude of an interest second to none in importance within the short space of a single decade, is a marvellous record of progress. In no other industry, and in no other country, has such a record ever been made. Such a report will do away with all necessity for expensive junketing parties who travel all over the country in the interest of municipal governments for the sake of obtaining information upon the subject. The report will be complete, reliable and easily obtainable."

"Will all the information come from electrical men?"

"No, we shall embody complete statistics relating to casualties and fires caused by electricity, which shall be gathered by disinterested parties. In short, we shall endeavor to publish all sides of the question, without fear or favor."

Mr. Foote concluded his preliminary labors last week and left for Chicago.

New Westinghouse Factory.

The new building at the works of the Westinghouse Electric Company, was completed a few days ago, and the necessary machinery is now being installed. It will be ready for occupancy by February 1st. This is the structure which has been put up in place of the one burned in September last.

The new factory is a six story brick structure; 60 by 150 feet are its dimensions, and its space will greatly add to the capacity of the works.

The ground floor is to be used for the storage of dynamos, exciters and motors. On the second floor will be a draughting room, and the rear portion is to be set apart for the winding department of large converters. The third floor will be used entirely for the manufacture of converters, 100 winding lathes being put on this floor.

On the fourth floor the manufacture of flat carbon arc lamps will be carried on, and 500 lamps is to be the weekly capacity. The fifth floor is set apart for the same purpose of arc lamp manufacture, while the sixth floor will be used as storage space.

The new building will form an addition to the works which the company, on account of its rapidly increasing business, has been greatly needing.

—— Hartford has voted to substitute electric lights in place of all naphtha lamps.

Electric Tramway at the Mills of the Salmon Falls Manufacturing Company, Salmon Falls, N. H.

A need of better facilities for the transportation of supplies and manufactures in many large mills and factories has led to the adoption of electricity as a motive power.

This has usually been easy to accomplish, owing to the fact that nearly all the important mills are provided with lighting plants, so that from the same dynamo that supplies the lamps sufficient current can be taken for the operation of an electric tramway.

The accompanying view is made from a photograph of the tramway recently installed by the Thomson-Houston Motor Company at Salmon Falls, N. H. The total length of the track is about 2,000 feet, extending the entire length of the mill yard; it is of standard size (four feet three and one-half inches), and laid with T-rails.

The same method of overhead construction as is employed on street railways is used here, the trolley wire being suspended from cross wires and brackets. In order to make the return circuit more perfect than would be the case if the rails only were used as conductors, a supplementary wire is run between them and connected by tie wires, one end being riveted to the rail and the other soldered to the supplementary wire.

View of the Electric Tramway at Salmon Falls, N. H.

The generator used for supplying the current is a shunt series machine, wound for 500 volts, and capable of delivering 15 horse-power. It is placed in the basement of the mill, and driven by water power. The motor car is 14 feet long and six inches wide. The truck, which has a wheel base of four feet six inches, is equipped with two 3 horse-power railway motors, capable of taking a load of 6,300 pounds up a grade of five per cent. without the least difficulty.

The advantages to be obtained and the saving in handling supplies and finished goods effected by the use of electric tramways, cannot fail in a short time to bring them into general use. They are just as applicable to interior, where a truck can be used to collect material, transport it to the elevators and to the various parts of the mill. The Thomson-Houston Motor Company has already made several installations of this sort, all of which are milling satisfactorily.

High Pressure Electricity.

S. Z. de Ferranti writes as follows: "To be prophetic, we will say that in the future our railways will be worked, our lighting will be done, our power will be transmitted to a great distance; all this will be done entirely by the aid of high pressure electricity; it is high pressure in electricity like high pressure in steam, which is going to carry—which is carrying—everything before it."

—— The borough authorities of Lansdale, Pa., have accepted a proposition from the electric light company of that place, to furnish arc lights for streets, 1,000 to 1,200 candle-power, for $40 per light per year.

Arc Light Photometry.

The experiments were mostly carried out with a Siemens differential lamp worked with a continuous current of 14 amperes, and taking a potential difference of 47 to 52 volts. The standard unit of light employed was the German normal candle, burning with a flame of a height of 45 mm. This may be taken as equal to the English sperm candle. As an intermediate standard of comparison, were used two Albert burners of 25 to 30 candle-power. It would, perhaps, have been preferable to use the amyl-acetate normal lamp of von Hefner-Alteneck. The arc lamp was suspended above the photometer bank, so as to admit readily of the light being measured in all directions, and under various angles.

The following table contains some of the results with a naked light:

Angle.	Left.	Angle.	Right.
.. ....	109	.....	136
46°—26′	1,992	46°—25′	2,009
61°— 8′	863	60°—42′	804

The E. M. F. varied between 46.7 and 47.1 volts.

From an inspection of the curves, it appears that the light, measured in a horizontal direction, is very small; it increases rapidly up to 20 degrees, and then more slowly, till it reaches a maximum at about 42 degrees, and thence once more it falls off. Soon after passing below 60 degrees the light almost disappears, owing to the shadow cast by the lower carbon, while still further below the lamp some light is thrown down from the crater of the upper carbon. The author gives a formula for calculating the mean spherical illumination from the light measured under the several angles all round the lamp. Experiments were also carried out with three different kinds of globes, and it was found that the mean spherical illumination lost respectively 41, 40 and 53 per cent. of that given by the naked light. By the use of reflectors the diminution of the illumination was reduced to about 32 per cent. The author finally treats of the mathematical calculations for arriving at the best disposition of lamps for illuminating any given area.—*Electrotechnische Zeitschrift.*

—— In response to an inquiry of Mayor Hart, of Boston, as to the success and cost of the electric light plant owned and occupied by the city of Bangor, Me., Mayor Bragg, of Bangor, says: "Our plant is a success in every particular, and far exceeds the expectations of even the most sanguine. It consists of 165 light dynamo capacity, with 140 lights actually placed in the streets. Everything is of good quality, and the work well done. Our total cost, including steam engine and boilers to be used in cases of emergency, has been about $33,000. The cost of operating, running all night and every night in the year, and making a liberal allowance for wear and tear, will not be far from $6,500 per year. This low cost is due to the fact that our plant is operated by water power owned by the city.

Electrical Sheep Shearing.

A remarkable application of electricity is being made in Australia. The problem of shearing sheep economically and speedily has been solved by the use of the electric motor in conjunction with a new shearing machine, invented by Frederic York Wolseley, a brother of the eminent General bearing that name. The method of using the shears is very simple, the operator having merely to throw a friction wheel into adjustment by means of a handle, and then push the comb into the wool, pressing it continuously forward and keeping it as closely as possible to the body of the animal being operated upon. From one to 100 shears can be operated at one time according to the power used. By this mode the shearing is done more mercifully than when done by hand shears, especially when performed as "piece work." The loss from injuries, primarily due to shearing by hand, reckoned at no less than one per cent. of the animals operated upon, is entirely avoided; while the pelts, being free from cuts, stabs and holes, command a readier and better market. The operators themselves are protected from the numerous self-inflicted injuries to which they are liable when using the ordinary hand shears; while sore wrists, aching hands, swollen arms, cuts and stabs, are now all alike regarded as things of the past. The time occupied in shearing the sheep by the new method is only from three and one-half to five minutes. As the machine takes the whole of the wool off at one operation, all second cuts are avoided, and thus considerable saving in time is effected.

Electricity vs. Snow.

The Thomson-Houston Company has received letters and telegrams from the users of its system in the West and Northwest regarding the operations of the electric roads during the severe snowstorms and blizzards which have lately prevailed. Without exception they all report satisfactory results, and what little inconvenience was experienced was insignificant as compared with steam or horse power.

President Murphy, of the Omaha Street Railway Company, reports that the line worked very satisfactory during the blizzard, and that people generally were elated over its success.

President Stewart, of the Omaha and Council Bluffs Railway and Bridge Company, reports that the electric equipment acted admirably and quite to his satisfaction.

President Powell, of the St. Louis and East St. Louis Electric Railway Company, reports general satisfaction.

President Todd, of the Northwest Construction and Supply Company, of St. Paul, says but little inconvenience was experienced. No difficulty was found in running a motor through eight and ten inches of snow with the scrapers down.

Vice-president Goodrich, of the Minneapolis and St. Paul Railway, says the electric did as well, if not better, than the horse car lines.

President Wood, of the Derby Street Railway Company, Birmingham, Conn., says that with six inches of snow cars worked well and not a single trip was lost.

Thos. G. Fitch, secretary of the Riverside and Suburban Electric Railway, of Wichita, Kan., says company operates 14 miles of road, and that wherever the company was able to get ground with the motors, no trouble was experienced. The Thomson-Houston motors worked while others which the company have were stuck badly. No trouble whatever was had with the overhead lines. Horse car lines hauled no cars for 48 hours.

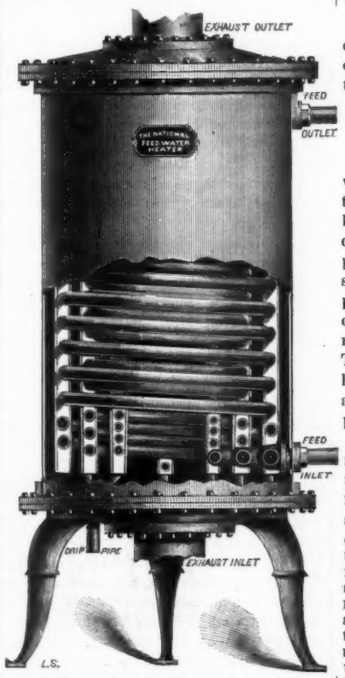
Minneapolis—Electric road passed through very severe snow storm last night. The cars worked perfectly, while our steam and horse cars were considerably delayed. (Signed) Thomas Lowry.

—— Speaking of the bill about to be introduced into the local legislature by the firm of lawyers of whom the chairman of the road committee is head, for the incorporation of a company for constructing subways for the placing of the electric wires therein, and for tearing up the roads for the purpose of erecting them, the city surveyor, of Montreal, Can., says he hopes the city will oppose any such thing. If the city wants subways it can make them a great deal better itself. The roads were under the control of too many people at present, and they certainly did not want anybody else to come tearing up the roads just as they were in good order.

The National Feed Water Heater.

The heater which is illustrated on this page is manufactured by the National Pipe Bending Company, of New Haven, Conn. It consists of a coil or series of coils of seamless drawn brass or copper tubes, contained in an iron shell. The cut shows the 400 horse-power size, which has three coils of tubes.

The liability to leaky joints is wholly obviated by the coils, which take care of all



contraction and expansion, and the flow of feed water to the boiler is free and easy.

The popularity of these heaters is attested by their large sale, especially to electric light and power companies, in this and foreign countries. Over 200 such orders have been filled for electric light companies, and over 300,000 horse-power in all has been sold.

Growth of Telephone Facilities in Connecticut.

The New Haven (Ct.) Telephone Exchange was started January 28, 1878, at which time there was not a telephone wire in the State of Connecticut. During the past year, according to the report of General Superintendent E. B. Baker, the Southern New England Company had 480 miles of pole lines, with 4,316¾ miles of wire in this State, January 1, and 5,693 subscribers, 1,944 being at residences, and 3,749 at offices. One hundred and fifty miles of these wires are underground, 20 miles under water. There are 1,240 circuits carrying single subscribers, 420 carrying two subscribers, and 1,027 circuits carrying more than two subscribers, a total of 2,687 circuits. This gives work to 226 regular employés. There are 120 public stations distributed throughout the State and 6,010 telephones in actual use, in a population of 615,906. Blake transmitters, 3,713; Edison transmitters, 28, and long distance transmitters, 326. There are 94 cabinet sets. The wires now reach every town in the State, and most of the inter-town business is done by metallic circuit.

Telephonic Communication in Holland.

The Dutch Bell Telephone Company is extending its system in different provinces after laying special new lines between Amsterdam and Haarlem, Amsterdam and Zaandam, Rotterdam and Dordrecht, etc., in accordance with the government regulations regarding their construction. After the completion of these supplementary lines, towns not hitherto in telephonic communication will be brought into direct contact, and Dordrecht will be able to converse with Haarlem, and Zaandam with Rotterdam and the Hague. The uniform charge for the use of these telephones is to be 50 Dutch cents, or 20 American cents, for three minutes' talk on the instrument. That the telephone transmitter never gives out under some of the Dutch words hurled against it may be taken as a supreme triumph.

FACTS AND FIGURES.

The profits of the Western Union Telegraph Company, for the year 1889, were $6,218,041. The average cost per message to the company was 22.4 cents, and the average toll per message was 31.2 cents. The company sent 54,108,326 messages during the year.

It is estimated that there are about 250,000 arc lights and about 3,000,000 incandescent lamps in use in the United States.

In the State of Ohio there are 93.25 miles of electrical railway tracks and 161 electric cars. Ohio leads the country in this particular.

Experiments with Accumulators for Station Working.

The two cells on which the experiments were carried out had formed part of a battery which had been in daily use from October, 1883, till December, 1887. Each cell contained three positive and four negative plates; the surface of each plate was 36 square dm., and the liquid was dilute sulphuric acid of specific gravity 1.115, the quantity being 3.4 litres. The cell, when ready for working, weighed about 20 kg. The capacity of each cell was 45 ampere hours, the normal charging current was five amperes, and the discharge current 6.5 amperes.

With the normal current the E. M. F. rises on charging from 2.09 to 2.1 volts at the end of half an hour, then falls again to 2.085, rising at the end of four hours to 2.09, and then increases steadily till the end of the eighth hour, when it rises rapidly, finally touching 2.34 volts. On discharging with a normal current the E. M. F. first rises slightly from 1.922 to 1.928, and only again reaches its former value after about one and a half hours; it then falls off very regularly till the end of the discharge. The remarkable rise of both curves should probably be attributed to some kind of secondary action. The resistance was very carefully measured, and was found to be proportional to the charge and to the discharge, respectively. The density of the acid was taken regularly, and found to be directly proportional to the state of charge of the cell; it varied from 1.115 to 1.147. This value agrees extremely well with the value arrived at from theoretical calculations, these giving 1.146, from which the observed value differed only by the third decimal place.

A considerable number of further experiments were made with currents exceeding the normal, the detailed results of which are all given in the paper.—*Elektrotechnische Zeitschrift.*

Taxing a Telegraph Company.

An interesting question regarding the taxation of corporations is being argued before Judge Tuley, at Chicago.

The Postal Telegraph and Cable Company is seeking to restrain Tax Collector Frank E. Barnard from enforcing a tax of $5,000 on its capitalization and franchise, and $5,400 on its tangible property. The Postal Telegraph Company leases the wires of the Board of Trade Telegraph Company, and its counsel showed that as to its own capital, that was exempt, the company being a New York corporation. He claimed, therefore, that the collector had no right to assess the Postal Telegraph Company on its capital stock.

Counsel for Collector Barnard said the tax was not extended on the capital stock of the Postal Company, but on the capital stock of the Board of Trade Company, which was in the Postal's possession. Then Mr. High, for the Postal Company, claimed that he did not object to the Board of Trade Company being taxed, but he did object to the Postal Company being compelled to pay its taxes. Mr. Gibbs, for Barnard, asserted that this was the law, and Judge Tuley will have to pass on the question whether the lessee of a telegraph line is liable for its taxes.

—— The following were elected trustees of the Richfield Springs, N. Y., Electric Light and Power Company: Allen Bloomfield, Albert D. Getman, James A. Storer, Myron A. McKee, Madison Vedder. Allen Bloomfield was re-elected president; A. D. Getman, vice-president; Willard A. Smith, treasurer; John Gyer, secretary; James A. Storer, manager.

Marseilles, Ill.—Articles of incorporation are filed for the Mendota Gas Company. The capital stock is $20,000, and the money is all subscribed.

Illinois.—Rockford Electric Railway Company, at Rockford; to operate a street railway; capital stock, $150,000; incorporators, H. H. Robinson, George M. Blake, Fred. Haines.

Chicago, Ill.—The Bushnell Electric Light and Power Company; to furnish light, heat and power; capital stock, $5,000; incorporators, C. H. Cline, G. A. Kaiser and I. B. Cummings.

Chicago, Ill.—The Rotary Magnetic Ore Company, at Chicago; to do a general mining business; capital stock, $500,000; incorporators, J. E. Smith, H. W. Smith, G. S. Finney.

Huron, S. D.—The Madison Street Railway and Rapid Transit Company, with a capital of $50,000, has been incorporated, and the work of building the lines will be commenced early in the spring.

Norfolk, Va.—The Norfolk Electric Light and Power Company has filed with the Secretary of State a statement that its articles of incorporation have been amended so that the capital stock is increased to $25,000, shares $50 each.

Bridgeport, W. Va.—An establishment will be located at Bridgeport, W. Va., to manufacture watchmen's electric clocks and a line of novelties. The principal stockholders are Messrs. W. T. Graham and J. J. Holloway, both of Bridgeport, W. Va.

Baltimore, Md.—The Writing Telegraph Company was incorporated, with a capital stock of $100,000, by Edwin F. Abell, B. F. Deford, Michael Jenkins, Richard Cromwell, James D. Mason and Arthur Stewart. It is proposed to do a general telegraph business.

Huntsville, La.—The Guntersville and Gadsden Telephone Company has organized, at Huntsville, by electing a board of directors and the following officers: President, Frank B. Gurley; vice-president, David Wise; treasurer, Archie L. Bison; secretary, W. H. Raymond.

Petaluma, Cal.—The Petaluma Electric Light Company has incorporated, with a capital stock of $10,000. The directors are George B. Codding, W. S. Pierce, J. H. Beggs and Col. S. H. Taylor. The object is to supply Petaluma with electricity, the former company having dissolved.

Iowa.—The Dubuque Electric Company has been incorporated, with a capital stock of $400,000. The incorporators are Wm. L. Allen, Thomas O. Swiney, John P. Van Patten, Ernst D. Allen and John N. Van Patten. The officers are Wm. L. Allen, president; John P. Van Patten, vice-president, and Thos. O. Swiney, secretary and treasurer.

Elgin, Ill.—W. A. Shepard, W. H. Wilcox, Richard E. Gray, James B. Lane, A. W. Root, E. C. Lovell and George M. Peck, are incorporators of the Elgin Electro-Hydraulic Company, with a capital stock of $250,000. The object is to generate electricity by the Gray current motor system, and transmit the same for power and light. Mr. Gray, the inventor of the motor, is a brother of Professor Elisha Gray.

Albany, N. Y.—The following certificate was filed: The Consolidated Gas and Electric Light Company, of Westchester county, formed by Charles B. Ludwig, Brooklyn; Harold S. James and Arthur B. Elbecke, New York; Hanford M. Henderson, Port Chester, and Leonard G. Levy, Newark, N. J. The operations of the company will be carried on in the towns of Rye, Mamaroneck, New Rochelle, Harrison and Scarsdale, N. Y.

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The next lecture before the Electric Club will be delivered February 20th by Grosvenor P. Lowrey. "Patent Law" is the subject.

Forty-three miles of new subways for the city of New York have been planned for this year. The streets of the city will present an animated condition when the work gets fairly started. It is to be hoped that the air will not be filled with flying manholes when this work is completed.

Notwithstanding the thousands of dollars that are now spent in all our large cities in electric lighting, the consumption of gas in these same cities has increased per capita. This is notably the experience of the gas companies in Boston, says the *Herald*, where the increased demand for light seems to warrant the belief that gas has still almost as great a future as electricity itself. There is, certainly, no longer any cause for the holders of gas securities to become alarmed.

THE ANNUAL REPORT OF THE BOARD OF ELECTRICAL CONTROL.

The first Annual Report of the Board of Electrical Control, of the City of New York, contained about 40 pages; the second Annual Report added about 40 pages, making 80; and the third, which we have just received, contains 276 pages.

Upon receipt of this imposing looking document, our anticipations were raised, and we hoped upon opening it to find matter both instructive and interesting. We regret to say that it contains neither the one nor the other.

The first part of the Report is practically a re-hash of the statements of the two former reports, and seems to be an attempt to explain why it is, notwithstanding the fact the board has been in existence for over three years, that it has not succeeded in putting the wires underground. This portion of the Report is a lamentable confession of failure on the part of the commissioners to do the work for which their commission was created. It admits that they generally understood what ought to have been done, but did not do it; that they tied themselves up to a company with a small capital who did not do the necessary work, and that the commissioners did not feel inclined to force them to carry out their contracts.

While the Report does not say it, the impression is made upon anyone who reads what they have submitted, that the board are, as charged by the grand jury, directly responsible for the disgraceful condition of affairs as evidenced in this city during the last two years.

That portion of the Report immediately following relates to a history of the litigation between the various electric lighting companies, the city and the Board of Control, and is chiefly interesting from the fact that the manifest inefficiency of the board is therein clearly stated. Why this matter should be incorporated in a report of this kind is beyond our comprehension.

The balance of the Report is given up to a report of the engineer and the electrical expert, both of which reports are remarkable for what they don't say, and the Report finally ends by a series of pictures, showing how the subways were intended to be laid but are not.

Taken as a whole, the Report seems to be an attempt on the part of the Board of Control to show, by the size of the volume, if nothing else, that it is a most practical and efficient board. That (in its mind) it had conceived a system of subways which would meet all the requirements, and that, if left alone—for how long is not stated, possibly five years more—it would and could get a portion of the wires in the city of New York underground.

We do not intend to pursue this subject further. The absurdities of the present Board of Electrical Control was evident to every one long ago. The pertinent question now is: What is to be done about it? And the answer seems to be sufficiently obvious. In the language of the New York *Sun*, "Clean the rascals out;" and constitute the board of men who are supposed to have a slight knowledge of the business entrusted to them. With a board made up of properly educated electricians, the Mayor and the Commissioner of Public Works, we have no doubt that the fourth Annual Report of the Board of Electrical Control will be a very different volume from that just received by us.

LITERARY SCIENCE.

The scientific man, and more especially the electrical man, must often wonder, when taking those occasional dips into high-class periodical literature, which we hope all electrical men do take, what mysterious and impenetrable barrier hedges around his favorite science so as to render it absolutely incomprehensible to the average literary man. Then, perhaps, he goes on to wonder that, given the utter incapability or unwillingness, whichever it is, of the literary man to grapple with matters electrical, he should allow his pen to run away with him to the extent of producing such lamentable rubbish and barefaced mis-statements as are to be found in an article entitled "Meditations on the Brooklyn Bridge," by George William Curtis, in the current issue of *Harper's Magazine*.

"By and by," says the Boston *Herald*, "it will be fully acknowledged that George William Curtis is the most graceful essayist now writing in the English language." Mr. Curtis' language may be graceful, but in the article in question it is anything but gracious. He starts out by boldly stating that the Boston fire was caused by the electric wires, and adds that it is shrewdly suspected that the Brooklyn Tabernacle was kindled by them.

As regards the Boston fire, an exhaustive enquiry failed to reveal the guilt of the wires, and, in fact, the weight of evidence was all the other way. In the case of the Tabernacle, it was conclusively proved, to the chagrin of an over-confident fire marshal, who declared the wires at fault without undertaking even a formal investigation, that the fire could not have been started by the electric light wires; not only had the current not been turned on, but to satisfy even the most skeptical the switchboard was recovered intact from the ruins of the building.

Mr. Curtis says that the laws of electricity are apparently ill-understood, and that the latest light-bearer seems to the householder "uncanny and lawless, and nobody is qualified to instruct him how to control and subdue its antics." The laws of electricity *are* apparently ill-understood; we are afraid that they are not sufficiently well understood by many whose business it is to understand them, but certainly that is no reason why literary men should discourse about them without understanding them at all, or attempting to understand them. Then, what instruction does Mr. Curtis' "courteous host" require in order to control and subdue the antics of the electric light? He is not going to tend his own engine and dynamo any more than he runs his own gas works; all he has to do is to turn switches on and off, and if he neglects to shut off the current properly, he is not poisoned in his bed as he would be by gas.

Our literary scientist next indulges in a cheap fling at electrical engineers generally. "The law requires the wires to be buried in the city, and the newspapers peremptorily demand the execution of the law. But the chief of experts in the use of lighting, who is presumed to know all because the rest presumably knows nothing, remarks that the wires of telephones and telegraphs and electric lights, and the pipes of gas and steam, will not make a subterranean happy family, but at any moment they may be mutually exasperated to a degree of fury which will hurl even the Equitable skyward." It goes without saying that such a fantastical exaggeration never emanated from Mr. Edison, but that is a point aside. Because Mr. Edison's name has been persistently "boomed" as that of an infallible wizard capable of grappling with every problem which the limitless applications of electricity offer, why should it be said that the rest, the great army of American electrical engineers, "presumably know nothing?" Mr. Edison himself would be the first to resent the injustice of such a sneer. Does Mr. Curtis or any of his readers suppose that the hundreds of thousands of arc and incandescent lamps which nightly gleam from one shore to the other of this continent, have been installed, with all their attendant machinery and ramifications of conductors, and are walked over and cared for by men who "know nothing?" Is the telegraphic system of the United States, the most extensive in the world, looked after by men who "know nothing?" Has the art of telephony, local and long-distance, with all its perplexing problems, been thought out and built up by men who "know nothing?" Are the factories and laboratories scattered all over the country, which daily turn out quantities of ingenious contrivances and useful improvements on existing electrical appliances, peopled by men who "know nothing?" The magazines have recently done much good in spreading a certain amount of knowledge of matters electrical by means of popular articles on different applications of electricity, and of such articles, written by men well posted on the subjects they deal with, we can never have too many. But effusions such as that of Mr. Curtis, which we complain of, based upon ignorance, and teeming with ignorance and prejudice, cannot be condemned too strongly; they undo the good work accomplished by men who know what they are writing about, and create false impressions abroad, as harmful to the interests of the consumer of electricity—and to-day almost every unit of the population is a consumer of electricity in some form or other—as to those of the producer. Every electrical engineer in America must resent such a slur on his profession, and none the less because it emanates from "the most graceful essayist now writing in the English language."

CORRESPONDENCE.

What is Transpiring in Electrical Circles at Philadelphia, Boston, Washington and Chicago.—Interesting Electrical News.

OUR PHILADELPHIA LETTER.

The Visitor to Philadelphia, in electrical circles as well as others, finds a difference. Noble, of the Westinghouse Company, claims that he was arrested three times by the policemen of the Quaker City, just because he was running to catch a train, his unusual speed causing the guardians of the peace to suspect that something was wrong. Although we are not as speedy, perhaps, as the citizens of your city of New York, yet there are a number of elements recognized as part of the make-up of Philadelphians that deserve recognition. We have a habit, when undertaking anything, of sticking to it and standing by it as long as there is any hope, and sometimes afterwards, as, for instance, the sticking to the Keely motor long after all hope has departed.

The Electrical Field in this city is not in a moribund condition, as some of the lively electrical workers of other cities would have the public believe. There are a great many manufacturing concerns who deal directly with the electrical public; notably, Alfred F. Moore, manufacturer of insulated electric wire; Partrick & Carter, one of the earliest houses in manufacturing and dealing in electrical supplies; the Cleverly Electrical Works; also a number of leading manufacturers of electric and gas fixtures, such as Thackara & Sons, Horn, Brannen & Forsythe, Hetherington, and others. Several new companies have recently been organized, among them the Quaker City Electric Company, manufacturers of dynamos and motors, the Grove Electric Meter Company, the Pentz Electric Meter Company, etc. De Kosenko & Hetherington is a new firm in the electric fixture manufacturing. Mr. Hetherington is a very popular and genial gentleman, widely known in gas fixture circles, and rapidly becoming known in electric lighting circles. His partner, de Kosenko, has the reputation of being one of the best artists in the fixture field, and the new concern enters the business with every prospect of making a pronounced success.

The Paiste Electric Switch Company has recently moved into new quarters on Market street, where additional facilities have been secured for manufacturing this popular switch. —Among the older companies should be mentioned Queen & Company, whose reputation for suppiying instruments of precision is not excelled in this country. They have a fine reputation for reliability and promptness, and are deserving of praise.—The Cleverly Electrical Works is under the management of Henry Alert Cleverly, and is rapidly becoming recognized as one of the rising electrical interests of the city. Mr. Cleverly, who is popular wherever known, has recently become interested in the success of the new club which has been formed in Philadelphia, known as the Manufacturers' Club, and is greatly disappointed if any of his visiting electrical friends are unable to accept his invitation to dine with him there.

The Westinghouse Company, which includes the Sawyer-Man Electric Company and the U. S. Electric Company, is ably and energetically represented in this city by Mr. Charles Affable Bragg, who is efficiently assisted in his work by G. Frothingham Porter, the latter gentleman formerly connected with the Faraday Carbon Company, and who has fitted into the electric lighting business with a grace and skill peculiarly his own. Mr. Bragg has been particularly successful in his work for the large interests he represents, and he and Mr. Porter comprise two as popular representatives of electric lighting companies as can be met with in the United States, and I am sure, Mr. Editor, that you will permit this slight word of praise to appear, for their friends will all be glad to know of their success.

Mr. W. T. Brown, the electrician at the general offices of the Pennsylvania R. R. Company, Philadelphia, is the inventor of the Brown electric protector, which was illustrated in your columns a few weeks ago. Here in Philadelphia we think the protector is a particularly good one, and expect to hear of its adoption quite generally.

There are a Number of large electrical schemes connected with storage batteries, electric power, etc., which I hope to be able to write you about at an early day. L. M.

Philadelphia, Feb. 1, 1890.

OUR WASHINGTON LETTER.

Another Experiment at the Seat of Government.—The attorney for the Carpenter Storage Battery Company has had a bill introduced in the House of Representatives, authorizing the commissioners to make contracts for lighting public buildings and streets in Washington by means of separate and individual storage batteries, with a proviso that no wires, either overhead or underground, shall be used. The proposition is to

charge the accumulators at a central station and transport them to the lamp posts. The posts are to be made with hollow bases large enough to contain a sufficient number of cells to supply one 16 candle-power lamp eight days and a clock to automatically turn the current on and off. The scheme is impracticable and the bill will not pass.

Lieut. W. D. Wright, of the Signal Service, who had charge of the government telegraph lines connecting Woods Holl with Martha's Vineyard and Nantucket, for several years, has disappeared from Washington, and left a deficiency in his accounts for telegraph tolls. His friends have known that he was suffering some mental aberration, induced by severe study over telegraphic inventions, and this is regarded as the cause of his present difficulty.

No Gas in Eckington.—This suburb of Washington is lighted entirely by incandescent lamps from the Thomson Houston alternating plant, and it is probable that the city gas mains will not be extended to that locality.

War Where Peace Should Prevail.—The conflict between electric lights and navigators continues to agitate the public. If some leading arc light company would send a practical man to confer with the Light House Board, and arrange a plan for supplying illuminating lamps and the requisite colored signal lamps for bridges over navigable rivers from one electric plant, it would do the public a good service and secure an advantage over its competitors. There are several bills relating to this subject now pending before Congress.

Legislators Becoming Educated in Electrical Science.—In the United States Senate, Mr. Harris, of Tennessee, in advocating the granting of an electric street railroad charter, declared that it is already established and that the day is not two years distant, and he hoped not ten months, when every Senator will become satisfied that a current of electricity not exceeding 500 volts is wholly innocent and absolutely free from danger to animal life. He expects to see within the next three years every street railroad in the District of Columbia propelled by electricity. He expressed the opinion that the Eckington road is the most complete of any in the world, and as free from danger as any horse railroad or any other system of street transportation ever devised.

Benevolence vs. Common Sense.—A scion of one of the ancient and chivalric families of Old Virginia, named Lovenstein, who is a member of the Senate of that State, has conceived the idea that it is his first duty to protect his fellow citizens from sudden death by electric shock. He is the patron of a bill before the General Assembly which provides that, after April 1st, 1890, nowhere within the confines of the commonwealth, shall there be any electric circuit or any substance or thing for the conducting of electricity, in which the electric pressure used shall exceed the following amounts: The non-pulsating continuous current, 800 volts; the pulsating continuous current, 550 volts; the alternating current, 200 volts. The bill also stipulates that all telephonic and other circuits, other than those for electric light, heat and power, shall be equipped with safety devices to prevent fires. A fine of $500 is the penalty for violation of the law, and vigorous legal remedies are provided for its enforcement. The enactment of this measure will close a number of arc lighting stations, including one at Alexandria, which is the property of the city corporation. The members of the council of that city are much excited over the question. The subject is to come up before the committee on general laws, at Richmond, on February 11th, when interested parties will be given a hearing.

Washington, February 1, 1890. G. C. M.

OUR BOSTON LETTER.

Shocking Questions Answered.—A correspondent of the Boston *Globe* sends these answers to the questions asked in a recent issue:

1. No, as the man in question forms no part of the electrical circuit.
2. No, for the same reason as 1, there being no appreciable difference of potential between the points where his hands are touching.
3. Yes, as he then acts as a conductor for the current between the trolley wire and the return conductor rail.
4. (1) Yes; (2) because the rails are connected together and with the underground wire, and form parts of the same return conductor, and consequently are at the same potential; this is analogous to query 2.

Electric Mutual Insurance Company.—Capt. William Brophy and Mr. Stephen E. Barton, both of Boston, have issued the prospectus of an insurance company which is to bear the above name. They propose to organize and incorporate a company under this name and title, for the purpose of insuring electric light and power generating or distributing stations (building and contents) against loss or damage by fire. The company will be located in Boston.

This company will doubtless occupy an unique position among insurance men and will fill a long-felt want among electric light people. Risks on electric light and power stations have always been considered hazardous by the majority of insurance men; probably on account of faulty construction work. One company, which we call to mind, classes electric light stations among the "hazardous" risks and just above "oils." Other companies will not write these risks at all.

This new corporation enumerates among its purposes, that of a system of thorough and frequent intelligent inspection. If there is any man in New England competent for just this sort of business, it is Capt. William Brophy.

The new company has received the endorsement of leading electricians all over the country.

State House Talk.—It appears that both the West End Street Railway Company and the Meigs Elevated Railway Company, have bills for elevated railways lying on the Senate table. Both bills pray for broad rights, and a very lively contest is predicted by those who keep posted on such matters.

The American Conduit Company, of Boston, has been awarded a contract to build three miles of conduit in New York.

Board of Aldermen.—Two reports have been received from the committee on electric wires on a petition from the Suburban Electric Lighting Company to erect poles in Roxbury, West Roxbury and Dorchester. The minority report, signed by Alderman Stacey, recommended that no action be taken until a public hearing was held. The majority report recommended that the order be passed. Both reports were accepted, and the matter was referred to the entire board.

House of Representatives.—Petitions have been received from the Edison Electric Illuminating Company, of Boston, for authority to increase its capital stock to $2,000,000, and from the Woonsocket Electric Machine and Power Company, and from citizens of Blackstone, that the company may furnish power and light to the people of Blackstone.

Lowell, Mass.—The Lowell bleachery has placed an order for a storage battery plant for 140 lights.

Greenfield, Mass.—The Greenfield Electric Light and Power Company has elected these officers: Directors, F. E. Wells, N. S. Cutler, J. W. Stevens, J. H. Sanderson, H. W. Warner; clerk, C. H. Keith; treasurer, F. E. Pierce; auditors, E. P. Hitchcock, J. W. Stevens. The dividends of the company have amounted to six per cent. during the year.

Mr. R. T. White, of 12 Pearl street, Boston, will have a very complete exhibit of his patented material for street railways at the Kansas City Convention.

The Boston Electric Club will hold its regular monthly meeting on Monday evening, February 3d, at eight o'clock, at the club rooms, 7 Park street. A full attendance is requested.

Canton, Mass.—The selectmen gave a hearing last week on the petition of the Blue Hill Electric Light Company, who ask for a franchise permitting them to light the streets. Decision will be rendered Monday night.

Lynn, Mass.—The Thomson-Houston Electric Company will shut down several days this week to take account of stock.

The Electric Gas Lighting Company, 195 Devonshire street, have sent out their seventh annual catalogue and price list, which is to supercede all former issues. It is a handsome pamphlet of 64 pages, which are embellished with many handsome cuts. The book reflects great credit on its compiler, Col. L. W. Burnham.

C. H. McKenney & Company have just placed a very tasty five light electrolier in the office of the Wright Electrical Engineering Company. The design is modern English.

Lighting of Chelsea.—A hearing was given at city hall last week before the state gas commissioners on the petition of J. B. Everdean and others, that the Chelsea Gas Company furnish incandescent electric lights by the meter system. Prof. Gilley stated that there are several kinds of sucessful electric light meters in practical operation in this and other countries which measure electricity much more correctly than any gas meter does gas. Also that in cities where the meter system has been used it has given much better satisfaction than the contract system. A large number of citizens said they would use electric lights in their places of business if they could have it on the meter system. The matter is in the hands of the gas commissioners.

Mr. Royce, of the Thomson Electric Welding Company, was a visitor to New York the early part of last week. S. L. C.

Boston, Feb. 3, 1890.

—— The annual meeting of the Edison Electric Illuminating Company, of New York, was held last Tuesday. The following were elected a board of directors: John I. Beggs, R. R. Bowker, C. E. Crowell, C. H. Coster, Thomas A. Edison, J. B. Henry, E. H. Johnson, J. P. Marquand, G. T. Peabody, T. S. Smithers, Spencer Trask, Henry Villard and J. Hood Wright. It was voted to increase the capital stock $2,000,000 more, and authorize the issue of $2,000,000 in bonds.

OUR CHICAGO LETTER.

The Mather Electric Company report the following sales: Pabst Brewing Company, Milwaukee, 600 Lights; Hotel Del Coronada, 250 lights; California Hotel and Theatre, increase of 400 lights; one 3 and 2 one horse-power motors for running fans in the Endicott Building, St. Paul, in which the above company are placing 2,100 lights.

The Electrical Supply Company have received the agency of the Habirshaw wire, and are in receipt of large shipments of all sizes. The company are also placing on the market a universal tin shade which will fit any socket.

The Columbia Lamp Company, of St. Louis, formerly owned by Mr. Rhotehinel and others, has lately re-organized, and are erecting a large building which they will occupy as soon as furnished. In their new factory the company will have a capacity of 500 lamps per day.

The Western Electric Supply Company, St. Louis, have opened for business at 310 North Third street, in the store formerly occupied by the Southern Electrical Supply Company. The management of the business is in the hands of T. J. Wilson.

The Sperry Electric Company report the following sales: Lehigh Valley Company, Packerton, Pa., 34 lights increase; Edison Company, Western, W. Va., 30 lights; Edison Company, Paterson, N. J., 60 lights increase; Atlantic Electric Light Company, Atlantic, Ia., 30 lights increase; Chas. Kaester & Sons, Chicago, 12 lights.

The Joliet Street Railway Company have lately received four cars from the Pullman Company. They expect to have 27 miles of road in operation soon at Joliet.

Personal.—Sidney Short of the Short Electric Railway Company, spent a few days of this week in the city.—Mr. I. L. Meloon, of the Thomson-Houston Electric Company, was a recent visitor at the Club.—Mr. Geo. W. Johnson, of Detroit, has lately taken up his residence in Kansas City, Mo., and now occupies the position of secretary and treasurer of the Gate City Electric Company.—Mr. Robert Wiseman has been appointed to take charge of the retail department of the Central Electric Company, in place of Mr. Low who lately resigned.—W. W. Low has severed his connection with the Central Electric Company, and will represent the Standard Carbon Company, of Cleveland, Ohio, in the West. Mr. Low has been with the Central Company for the past two years and is well-known in electrical circles.

The "Review" representative is in receipt of a very neat combination card case and memorandum book from Shay, Stephens & Company. On the cover is a very modest advertisement, protraying the fact that they are manufacturers of insulators and battery jars. Mr. Stephens has added to his private office two glass pipes with stems six feet in length, no doubt with the intention of smoking the pipe of peace with his many electrical friends D. B. D.

Chicago, February 1, 1890.

The Subways of New York.

A meeting of the Board of Electrical Control was held last week. Permission was granted to telegraph and telephone companies to use subways to be built in a number of the streets of New York. Mayor Grant was anxious to have all the necessary subways built at once. Mr. Lauterbach, of the New York Telegraph and Electrical Subway Company, said the work laid out covered 43 miles, and if the board consented it would be divided between two construction companies, Mr. Lauterbach holding that his company had the right to sublet.

The Mayor said he would like to think the matter over, and on motion of Commissioner Hess, it was referred to the corporation counsel.

Mr. F. R. Hastings, treasurer of the Edison Company, in a recent address delivered in Boston, is reported as follows: "The high tension people have been having a very hard time of it in New York, and I believe that a large number of accidents have been due to the faulty condition of other lines which have been broken loose by abrasion or by the wind, and have thus been the means of communicating these high pressure currents to wherever the wires go. I believe that the first step to secure safety will be to put all those low tension wires underground in subways where they will not interfere with other currents, and have the high tension wires overhead properly and substantially constructed. This, at any rate, will, I think, reduce the danger to a minimum."

The REVIEW made the point contained in the speaker's last sentence in an editorial several months ago, and we agree with Mr. Hastings, that it is worth careful consideration.

PERSONAL.

Dr. Moses G. Parker, of Lowell, was an Electric Club visitor last week.

Mr. E. T. Gilliland has returned to the city from the West somewhat improved in health.

Geo. H. Hartwell, lecturer on electrical topics, is in the city, and will probably make New York his home.

Mr. Jno. D. Easterlin, superintendent of the Southern Bell Telephone Company, has removed his office from Charleston, S. C., to Macon, Ga.

Mr. Chas. M. Catlin, formerly a member of the examining corps of the Patent Office, has become associated with Messrs. Dyer and Seely, the well known patent lawyers, at 40 Wall street, New York.

Mr. Geo. H. Roe, of San Francisco, was a pleasant visitor at the ELECTRICAL REVIEW offices last week. Mr. Roe is in the east on electrical business, and will take in the Electric Light Convention at Kansas City on his return.

Col. Gardiner C. Sims, of Providence, in addition to winning honors in steam engine circles, has recently been elected vice-president of the Globe National Bank, one of the best banks in Providence. As Col. Sims is also president of the Stafford Manufacturing Company and vice-president of the Tunis-Sims Lumber Company, he ought to be fairly well occupied.

Mr. William Cull, formerly superintendent of the Hudson River Telephone Company, has tendered his resignation to enter upon the duties of manager of the electrical equipment of the Albany Street Railway Company. Mr. Cull is well and popularly known in telephone circles, and will receive the best wishes of numerous friends for his success in his new field.

Mr. Charles A. Bragg has just contracted to place two 600 light dynamos of the United States Company in the Pennsylvania Railroad Company's Fourth Street offices, Philadelphia. This plant is a duplicate of the very handsome plant placed in the new Girard Building, Philadelphia, and will be a very complete one when finished, as are all the plants installed under the direction of Mr. Bragg.

From Chicago to Kansas City over the Burlington Route.

The following notice has been sent to the members of the National Electric Light Association:

The undersigned, committee of arrangements on transportation, take pleasure in announcing to the members of our association that the Burlington route, Chicago, Burlington and Quincy Railroad, has been selected as the official line to carry the delegates and their friends to the annual meeting at Kansas City, February 11, 12, 13 and 14.

A special Pullman vestibule train will be run from New York City. This train will be lighted throughout with electricity, and at Chicago, additional electric lighted sleepers will be added.

The solid train thus formed will leave Chicago Monday, February 10, 1890, at 5 P.M., arriving at Kansas City the next morning. Applications for sleeping car space in the special cars which are added at Chicago, should be addressed at once to W. W. King, city passenger and ticket agent, C., B. & Q. R. R., 211 Clark street, Chicago.

RATES.

A rate of a fare and a third for the round trip, on the certificate plan, has been obtained, certificates to be signed by Allan V. Garratt. To secure the excursion rate, tickets going should be purchased at the regular one way rate, for which a special form of receipt will be given. On presentation of this receipt by the original holder within three days from date of the close of the meeting, at the Burlington route ticket office in Kansas City, return tickets will be sold at one third the regular fare, provided the receipt has been properly endorsed at the meeting by Mr. Allan V. Garratt, secretary of the Association. On this basis, the cost for the railroad ticket for the round trip from Chicago will amount to $16.67.

If lower rates than those quoted above are prevailing to Kansas City at the time of this meeting, delegates can, of course, avail themselves of the same.

C. H. WILMERDING, *Chairman.*
F. E. DEGENHARDT,
W. A. KREIDLER, } *Committee.*

Telephonic News

*** A telephone line will be built between the towns of Warren and Cleveland, Ohio.

*** An effort is being made to create a new officer at St. Louis, Mo., to inspect telephones. Some electrician will get the place if it is created.

*** The N. E. Telephone Company is erecting a line for long distance telephoning from Boston to Dover, N. H. They have completed it as far as Portsmouth already.

*** A telephone without a transmitter is reported from Chicago. Here ought to be an opportunity for the man without a palate to come to the front.

*** Gen. Thos. Sherwin, auditor of the American Bell Telephone Company, and Mr. Thos. B. Doolittle, of the same company, left last week for the Pacific Coast, to be absent a few weeks.

*** The Southern Oregon Telegraph and Telephone Company, of California, intends to construct a telegraph and telephone line from Grant's Pass to Crescent City, Del Norte County, Cal., a distance of 100 miles. Work will begin at once, and the line will be completed within 90 days.

*** The Common Council, of Rockville, Conn., will ask for an appropriation of about $8,000 for the electric lights and the police department this year. The 74 electric lights on the streets will probably be contracted for at the rate of $75 per light a year, from dusk until midnight, on 300 nights.

*** The Nebraska Telephone Company gave a banquet in honor of Prof. Alexander Graham Bell, at the Union Club, Omaha, Saturday evening, January 25th. The REVIEW was invited and is sorry not to have been present, for where Dickey and Drake and Korty are the hosts, every guest is sure to be made happy.

*** At a meeting of the directors of the Northern New York Telephone Company, at Lowell, Mass., the following showing was made for the quarter ending December 31: Earnings, $3,773.34; expenses, $2,514.94. A quarterly dividend of 1½ per cent. has been declared, payable February 1st, to stockholders of record January 24.

*** The Duluth, Minn., Telephone Company has issued its annual statement for 1889. The company now has strung 300 miles of wire and has 500 telephones in use. It has wires strung for a direct distance of over 23 miles, connecting Lakeside, Duluth, West Superior, Superior and South Range, nine miles beyond Superior.

*** The petition of the Rhode Island Electric Protective Association to the Board of Aldermen, of Woonsocket, R. I., through their agent, G. M. Brown, that they be permitted to run wires from the police station to the various banks, was received and placed on file, and an accompanying resolution, stipulating that the wires should be strung on poles already erected, and that the work should be done under the supervision of the committee on streets and bridges, was passed.

*** The annual meeting of the Missouri and Kansas Telephone Company, held at Kansas City, Mo., on the 22d ult., resulted in the election of the following directors by the stockholders: J. S. Chick, Kansas City; W. B. Clarke, Kansas City; C. D. Crandall, Chicago; George Albree, Chicago; S. A. Walker, St. Joseph; J. R. Mulvane, Topeka; T. B. Sweet, Topeka; J. E. Hudson, Boston; E. E. Cook, Davenport. The directors re-elected the old officers. They are: President, J. R. Mulvane, Topeka; secretary, W. W. Smith, Kansas City, Mo; treasurer, N. R. Ferguson, Kansas City, Mo.

"THE ACOUSTIC PRINCIPLES UNDERLYING THE ART OF TELEPHONY."

BY PROF. CHAS. R. CROSS, OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BEFORE THE ELECTRIC CLUB.

Mr. President, Gentlemen of the Club:

I suppose one of the most striking things which we notice at the present time, is, on the one hand, the exceeding fineness of specialty into which scientific or technical work necessarily runs, and, on the other hand, the wonderful manner in which the various branches of science, both pure and applied, overlap one another, and are interlinked with one another. The relations between electricity and heat are forced upon our minds by the incandescent filaments that we see about us; the relations between electricity and chemistry come to our minds whenever we see any of the various operations of electro-plating, or electro-deposition, that are so common; the relations between electricity and light, or rather, the oneness of electricity and light, are brought to our minds by the wonderful mathematical researches of Maxwell on the one hand, and the exquisite experimentation of Hertz on the other; the relations between sound and electricity are brought to our minds whenever we listen to a message through a telephone, or, in turn, send one.

This being the case, it needs no apology from me that I select as the subject about which I will speak to you this evening, an acoustic rather than an electrical one, what I have chosen to call "the acoustic basis of telephony."

The principles of sound necessarily underlie any and all transmission of speech by electricity. I have chosen an old subject, regarding which I shall have no absolutely new facts to bring forward, a subject which, perhaps, would have attracted more attention popularly ten years ago than now, rather than to take some one of the various newer subjects which one might possibly have chosen more naturally, for the reason that even many persons who are engaged technically in carrying on various branches of the art of telephony, while conversant with the subject through their reading, yet have not seen many of the experimental illustrations upon which our knowledge of that subject rests, and upon which our theories are based. I have, therefore, endeavored, tonight, to bring together a number of such illustrations. Of course, they must be taken as illustrations and not proofs, because no single experiment of itself actually proves anything. These will help to make clear the points of acoustics which one has to keep in mind in the theoretical study of telephony. The subject is a long one, and covers the theory of quality, and I have a very considerable amount of ground to go over, so that, without further preface, I will proceed at once to the discussion of the subject. Some of the points I have to consider will be very elementary. With some of the experiments you will doubtless have been familiar, even as school boys, but before we finish the subject I shall endeavor to show you some which are newer or more suggestive. * * * *

At the very outset of my discussion of any subject with which acoustics is concerned, we first meet the preliminary question as to what sound is, and, as every one is aware now-a days, it is due to the rapid vibration of the sounding body, which communicates, in its turn, vibrations to the air, producing waves—or it may be to some other medium surrounding the body, which vibrations pass through the air until they fall upon the ear of the hearer, and there, by a process which we need not analyze, produce the sensation of sound. That sound is due to the rapid to and fro vibrations of the body, can be proved by thousands of experiments. It is made evident here, when I place this little ball against the vibrating prong of the tuning fork, the ball being thrown away from the fork by the rapid blows of the prong, showing that the body is in a vigorous state of vibration.

If I hold a card against this toothed wheel while it is revolving, it gives a series of taps; spinning it rapidly and pressing the card against it, we find these taps fuse together into a continuous sound. When we have more taps of this particular kind than perhaps 60 or 70 per second, they fuse into a continuous sound as you observe, and as I diminish the rate at which the teeth strike the card, which I do by pressing my finger lightly against the axle of the wheel, we find the pitch to fall lower and lower still, as long as the experiment is continued, until the pitch finally becomes very low indeed.

It is a well-known fact that with a tuning fork, such as I have here, mounted on a box and bowed carefully, if the prongs of the fork are moderately stout, then after a few moments the law of its vibration is identical with the law of the vibration of a pendulum. Now, we can represent the mode in which a tuning fork, or any body vibrates, in a very simple manner. (Going to the blackboard.) Suppose we draw a horizontal line which represents intervals of time, and then suppose we divide it into a series of equal parts. To represent the form or mode of vibration, draw vertical lines to represent the distance of the prong from the position it occupies when at rest at successive equal intervals of time. Since the prongs move backward and forward in this way, we shall get some such curve as this sinuous line (indicating). If my curve was mathematically constructed, instead of being very rudely drawn, we should find that it possesses particular characteristics. It is called the curve of sines. Now, if we take another fork an octave above, it vibrates according to the same law, only twice as fast. These vibrations would be represented by some such curve as that, with twice as many sinuosities, assuming it also to have a smaller amplitude. Taking another fork, still higher in pitch, it vibrates three times as fast, and we should have a curve presenting three periods of the latter to one of the former (indicating). It is clear that we may have several of these vibrations, all having a certain form represented by this curve of sines, and following exactly the same law as to the variation of the velocity of the moving particle, which may, nevertheless, be of different amplitudes and rates. Now, it is evident that we can combine these two vibrations in this way, and, therefore, if we wish to represent that combined vibration, we should do it by simply striking a new curve, taking the horizontal distances in the same manner, and drawing the vertical distances, which should be the sum of the ordinates.

Let us take a vibrating string, and see if it can be caused to vibrate in different ways. I have here a single string, stretched between two bridges, and which will act in its vibration precisely as strings similarly mounted in musical instruments. If I bow in that way (bowing the string), we get clearly and distinctly the fundamental tone; but suppose I touch the string lightly with a feather at its middle point, that feather will not stop its vibration as a whole, and we get another note, an overtone, an octave higher. I do not stop the vibration of this part of the string with that feather, for, you see, if I touch it firmly with my finger, the sound ceases instantly. At a third of the length we get another note, higher than before; at a quarter of a length we get another note, higher still. You see, then, that this string is capable of vibrating in such ways as to give forth quite a number of different notes. Now, the manner in which this string vibrates, as observation shows, under these circumstances, is this: When it is producing this fundamental alone, it vibrates in one segment, with two nodal points, one at each end, the point of vibration being in the middle of the string. When touched with the feather at one-third of the length, it vibrates in three segments, and when touched with a feather at one-fourth of the length, it vibrates in four segments, and so on. I can illustrate that to you by a simple experiment, using a rubber tube stretched out, and you will readily see that the string is capable of vibrating in the way indicated on the board. Suppose we have the string vibrating in one segment; if it vibrated 40 or 50 times a second, or upwards, it would give a note, its fundamental. By varying the rate at which I move my hand (indicating with a rubber tube), and changing slightly the tension, I cause the tube to vibrate in two segments, as the cord vibrates when producing its first overtone, the octave. (Indicating.) Now, it is vibrating in two segments, with a node at each end and one in the middle, and with two intermediate segments. Again, with a little care, though perhaps with some difficulty, I think we can make it vibrate in three or four segments. (Indicating.) The whole thing merely consists in timing the rate of my hand correctly. Now, I think we can get it in four segments. (Indicating.) So that the string or cord, whose vibrations you can readily see, evidently is capable of vibrating in the manner in which I have said that this cord or the sonometer does vibrate. * * * *

Let us pass to speech. Does, or does not, the human voice possess quality differences of this kind? The slightest observation shows that it does. Different voices have different qualities; some are agreeable and some are disagreeable, and really no further remark is required with regard to this. We observe differences in quality in different voices, as we do in different instruments—the organ, piano, violin, and so on. But we also observe differences in quality in the same voice, and to consider only a single instance, take the difference in quality in the vowel sounds. We say with the same pitch, and as nearly as possible with the same loudness, *ou, o, a, e, i* (indicating), and you know which vowel sound it is. It is not by pitch difference, nor by difference in loudness; it is by difference in quality. We find, then, as soon as we come to study human speech, variations of quality existing in the same voice, as distinguished from different voices. These differences are in the partial tones present, which we find in a musical instrument in the relative pitch, intensity and number of vibrations.

And find another very common characteristic—that every vowel possesses a peculiar note or notes characterizing it, so that beside the phenomena that we observe with musical tones in general, we observe these certain additional ones in speech. Speech is, as every one knows, produced by the vibration of the vocal cords within the larynx. The membraneous cords attached to the side of the larynx are free and rest with their edges open, so as to leave a little aperture in the operation of breathing; but in speaking or in singing, they are stretched so as to leave only a little chink, so that when the air is forced from the lungs the cords fall into vibration. The quality of the sound produced by the vocal cords is changed by varying the tension of these cords; or, in the same way that the string of a violin, or the membrane of a kettle-drum, is made to produce variations in pitch. * * * *

The other method, which Donders used, is very ingenious, but more difficult of application; pitching a whisper. If we whisper different sounds, we shall get a change in pitch. In whispering we do not use the vocal cords at all; it is wholly done with the lips, the cheeks and the vocal cavity. There are obvious differences which, I think, you will observe. If, instead of whispering any vowel, I just shape my mouth to produce that vowel and then breathe outward, it will be analogous to blowing across the resonator. As I blow across this set of resonators, you get differences of pitch. Now, let me try the same experiment with myself (breathing the vowels), by panting vigorously, as it were, in that way and yet trying not to pronounce the vowel. You will catch the difference. Now, I will try to whisper, which is easier, because it does not take such a flood of air to produce the effect. And next I will try speaking those notes at the same pitch. I think you will get the rise of the characteristic note in passing from one to the other. If I first whisper these notes and then blow over the corresponding resonators, you will observe that the pitch is the same. These resonators are spherical and you do not get the same damping of the vibration as with the flabby cheeks and organs of the mouth. I believe that in one or two cases where the vocal cords have been exercised, artificial vocal cords have been inserted. This shows how purely mechanical an operation the production of speech is.

We understand, I think, now, in a general way, from what I have said, what it is in an instrument that goes to reproduce quality, and what an instrument to reproduce speech must do. We know that the vibrations of different sounding bodies produce waves in the air. In the case of a sound wave, we do not have the onward motion as in a water wave, but something such as we get here. (Indicating on blackboard.) Our vibrating bodies do not produce in the air waves like that—the particles of the substances transmitting it do not move up and down, but there are alternate condensations and rarefactions in the air, as you notice when I turn this apparatus (indicating)—the particles congregate together more closely at this point, and here (indicating) they are further apart. If you watch this you will see the condensation, which I am trying to follow with my finger, moves from one end to the other, and the rarefaction follows it. Motions similar to these are produced in the air particles, and so the vibratory wave motion, starting with the sounding body, reaches the further end of the line, and, of course, you must have all the peculiarities of vibration, rate, amplitude and form of vibration, possessed by the sounding body taken up by the air, and characterizing the sound wave. If then, we are going to reproduce quality, we must reproduce these various elements that I have spoken of. If we reproduce quality by an acoustic telephone, like the lover's telephone, which I have here, of course it is merely necessary to have a membrane to take up the vibrations produced by the voice, which communicates its little pulls and relaxations of pulls to the string, which acts upon the other membrane and reproduces corresponding vibrations.

Suppose we have to do this electrically—we have to do what was suggested, in 1854, by Bourseul. We must have a disk capable of taking up the vibrations of speech from the air at one end of the line, and at the other end of the line a disk which is so excited by electricity as to vibrate in substantially the same manner. The air at the transmitting station is caused to vibrate, and you reproduce, at the receivng station, the speech produced at the transmitting station. But how to make use of electricity was not suggested. That, of course, was going but a very little way, but it seems to me to be deserving of a great deal of credit, it being the first instance in which any one, in a distinct published statement, seemed to have appreciated the physical and acoustic conditions which must obtain in order to reproduce speech.

But we see that we must go very much farther than this, because we must find in some way how to bring about the vibration of the diaphragm at the receiving station.

Can we do it by simply making and breaking the circuit at each principal vibration? Making and breaking the current thus can simply give you the pitch—simply produce at the further station a note of the same pitch as that which is produced at the transmitting station. Considering simply the opening and closing of the circuit and nothing else, it can do nothing further, because the diaphragm or disk is merely pulled in the one direction when the circuit is closed, and released when the circuit is open, so that motion takes place in the opposite direction—a sudden violent pull, and an equally sudden release. You can reproduce thus a note having a pitch identical with the pitch of the sound at the sending station. It cannot reproduce the intensity. It does not and cannot reproduce the amplitude or the form, because all of these variations of the curve (indicating) are obliterated. You simply have the rate of motion determined, whatever the mode of vibration of the diaphragm may be while the circuit is broken or while it is made, is really of no account. Suppose we can arrange it so as to make and break on the partial tones. That seems very specious, but there is a fallacy underlying it which calls for notice. It is very easy to see if you tnink of a simple vibration like that. We will imagine some arrangement to make and break on each full vibration, and each overtone also, and reproduce those two partials, and thus reproduce the quality. Setting aside one important point, and admitting, for the sake of the argument, that you could do it with a tuning fork curve like that, what are you going to do with a curve having no sinuosities, like a curve from the organ pipe? Or, in a vibration representing the form of vibration of a violin string or a stop organ pipe rich in harmonics? Or, admitting that you can do the thing mechanically, you do not solve the problem. That is not the end of it. Suppose we admit that you do make and break the current as suggested. The sound produced by making and breaking a circuit a given number of times per second, has no relation to the quality of the sound of the instrument that produces it. It makes no difference whether it is the sound of a kettle-drum, fife, the human voice, or the tuning fork. If it is so many times per second, you will get one and the same sound from the receiver, providing you have only this circuit breaking action I am talking about. To illustrate by an experiment. Here is a tuning fork vibrating 128 times a second, giving a note identical with the resonator. Here is an ordinary telephone, whose circuit the same fork makes and breaks 128 times a second. The tuning fork, as you hear it, whose sound I can strengthen by bringing this resonator near the fork, gives us the quality of the sound characteristic of such a fork, which we are trying to transmit by circuit breaking. Notice what the result is when we send the intermittent current through the telephone. You get a sound totally different in quality from that from the fork strengthened by the resonator. That which I have shown you to be true, so far as a single illustrative experiment can prove it, if true for the single note, must be true, however many partials you may have; you will simply have more of these wheezy sounds added to one another, and, undoubtedly, a greater noise, but nothing in any way resembling the original note. There is nothing peculiar to electrical action in that. You cannot use a set of ordinary sirens corresponding to a set of forks to produce sound. If you sounded the sirens you would not have the clarinet or the trumpet quality, because the impulses of air blown through a set of apertures such as are found in the ordinary siren, gives a harsh noise. But if you use a wave siren—a disk having a sinusoidal curve cut on its edge, the air being blown against the disk through a little slit—you find that you do reproduce the quality of tone, and you can reproduce with one of these, as well as with the tuning forks, the quality of the various sounds.

To transmit speech we have got to produce electrical waves; we must throw the current into a state of change corresponding in rate to the pitch of the sound we wish to transmit, in extent corresponding to the intensity of the sound; and the form of the curve representing these vibrations must correspond to the form of the curve representing the sound vibrations which we wish to transmit. Whether we use variations in the electro-motive force in the circuit, or whether we make use of a variation in the resistance, as with the microphone, or vary the capacity of the circuit, as in the unused condensing transmitter, makes no difference as far as the theory is concerned. If we can cause in these ways, or in any other ways that may suggest themselves, these variations in the strength of the current to take place, we can reproduce quality; if not, we cannot. You can have all variations of reproduction, from the greatest perfection to the reverse of that, but you will get perfect reproduction in proportion as you approach this condition of things.

I have sometimes heard the term, "electrical undulations," characterized by well-known scientific men. It has been said that we cannot properly speak of the waves of a substance regarding whose nature we know so little, as of electricity. The reasoning seems to me very false, although I have oftentimes heard it from persons from whom I should not expect to hear it. The early idea of the wave was the water wave; but in the case of water there was the up and down motion. When Mersenne and others studied sound waves two centuries ago, finding that the air particles went through a periodic change, such as we have seen in the particles of this model, they borrowed the term "wave" from the water wave, and applied it to the case in which you have a longitudinal motion of the particles, a condensation and rarefaction, there being a gradual passage from one phase, maximum condensation, to the other phase, maximum rarefaction.

Now pass to the current of electricity. Suppose you have a long line of air waves, and suppose that in some way you could congeal the air, freeze it, keep it permanently in its momentary shape; and imagine then you could have a little series of pressure gauges arranged along from inch to inch; or suppose you could tap off a portion of air and measure its density, you would get some sort of a curve. If it was the sound of a tuning fork through the transmitter, you would get some such figure as that.

Now, suppose you use a telephone and consider the distribution of the electricity along the wire. You have variations in density from point to point; and suppose you use a set of electrical gauges, keeping the electricity in your imagination unchanged for an instant; suppose you could tap off little charges, a foot, or a mile or 100 miles (passing from inches of the sound wave), and find what the density is, and then draw a curve representing the density and making the scale of the two curves different, reducing the length of the horizontal line when we draw our electrical curve, in order to make up for the enormously greater velocity of electricity, and then draw another curve (the two curves will have the same form). (Indicating.) From such considerations it seems to me we could not ask for a fitter term to describe these changes than the expression "electrical undulations."

Gentlemen: I have spoken at very great length this evening, considering the hour at which I began. I have only, in closing, to thank you for the great attention you have given me.

THE DISCUSSION.

In the discussion which followed, the lecturer was complimented by all, Messrs. J. J. Carty, W. D. Sargent, J. D. Lockwood and others, speaking briefly.

Prof. Geo. Forbes, of London, said one thing struck him forcibly, and that was that we, here in the Electric Club in New York, can listen to a lecture on acoustics and feel that we, as electrical engineers, are better for it. It is a good omen for the condition of electrical engineering that people realize that we must have a very considerable and extensive knowledge of physics, besides the immediate facts of electricity which may come before the ordinary routine mechanic. I think no happier illustration of the desirability of having a knowledge of general physics, with the special information required for electrical engineering, could have been shown than in the interesting lecture which Professor Cross gave us this evening. As pointed out to us, by a series of beautiful experiments, many of which were devised specially with the object of illustrating some of the profoundest methods of investigation, he has shown us as clearly as possible that the quality of speech depends upon the various overtones with which it is associated. This leads one intuitively to say that if we wish to perfect such an instrument as the telephone or the phonograph, in which we find a difficulty in the reproduction of the quality of speech, all that we have to go to is to the simplest forms of the overtones of the musical note, and study them until able to master them. That is exactly what men have been doing in the working out of such instruments, and is being done at the present time with the phonograph in order to reproduce the finest points in speech which have been difficult to attain in the past. I, for one, feel heartily indebted to Professor Cross for leading us to see so vividly how a general knowledge of physics will help us vastly in all our engineering work, and I think everybody here will agree with me, that we have to thank Professor Cross very much indeed for having opened what he called his "natural embouchure" with great effect this evening." (Applause.)

Professor Le Conte Stevens: During the past 25 or 30 years we have all become very familiar with the term "evolution." We have the evolution of the universe, the evolution of the earth, the evolution of society, the evolution of morals and a general evolution of science, especially certain departments of science, such as electricity and acoustics. There is no man in this country who has done more during the years in which he devoted himself to the subject, than Professor Cross. I had been watching him for a good many years before I met him personally, and spent a good deal of time myself in experiments similar to these this evening. I think, therefore, that I may claim to be an authority, at least to this extent, that I know how difficult it is to attain success in some of those experiments, and I can, on that account, appreciate the more readily, the beautiful results he has given us this evening.

Professor Cross has given us the principles on which our knowledge of the telephone is based, and has particularly brought out very finely the subject of musical quality. I am sorry that he did not have more time in which to develop that subject, although we are heartily indebted to him for doing so much as he did within the limited time. There is a great deal more that he could say, if he had a full chance. He could have told us something about the history of the investigation of this subject; he could have told about the investigations made by Professor Preece, of London, with whom you are well acquainted, and by Professor Ferguson, in which the telephone was used, and in which, by means of a stylus with a long arm, the actual curves were obtained, similar to those indicated by Professor Cross upon the blackboard. He could, also, have said more in regard to the subject of the different elements going to make up musical quality, of which it is hard to speak definitely, but upon which some remarkable experiments have been performed by Rudolph Koenig, of Paris. He used the wave siren—a combination of disks, or a combination of cylinders in which the curves have been cut. By revolving those cylinders, and by varying the position of the little slit through which a blast of air was directed against these curves as the disk was revolving, he showed very conclusively that the quality of a musical tone depended not only on the form of the vibration and upon the number and relative intensity of the overtones accompanying the fundamental, but also upon the phase in which those tones combined. If you express, by a series of sinusoids, the octave, the twelfth, the double octave, and so on, let it start at a given point, and you have the curve easily constructed mathematically. Suppose the first sinusoid to begin at zero, the second at five, ten or 15; then the selection of the points on this horizontal line at which the phases of the overtones combine with the fundamental, will make a perceptible variation in the quality of the musical tone, easily recognized by a practiced ear. I had the privilege, two years ago, of spending some time in Paris, and trying this wave siren with Mons. Koenig, and I can testify that he has substantiated the point he claimed a good many years ago, and for which he did not receive the credit due him. Koenig came to America in 1876, and brought his wave siren. Unfortunately, it was damaged in transit from Europe here. It was placed in the Centennial Exposition. All that the judges could say of it was that the object of the siren was to establish such and such points. It is well known to those who have been keeping up with this subject, that Helmholtz, a man whom we all honor and admire, has not given to Koenig the credit due him. Helmholtz visited Paris and is said to have poohpoohed the whole subject as brought out by Koenig. But I think all that is necessary is for those cultivated in music to listen to this wave siren, and find that while Helmholtz has never stated an untruth, nevertheless, it is possible for a scientific man to know a part of the truth, to establish it well and bring it out beautifully, and yet not know the whole truth. Koenig must have the credit for bringing out something additional, and I hope it will some day be established by means of the telephone, which Professor Cross has been studying so carefully, and the principles of which he has brought out so beautifully this evening. (Applause.)

Professor Cross: I thank the gentlemen of the Club, and others, who have spoken so pleasantly of what I have tried to do this evening, and certainly must attribute much of their appreciation to the inherent interest of the subject itself, rather than to anything that I may particularly have said.

Professor Cross concluded with a brief reference to Koenig's researches, and also made some suggestions as to the obscure points in the theory of quality.

.... The Postal Telegraph Company has been working rapidly with its construction force, and it is expected that by the close of this week the line will have been extended to Savannah, Ga.

.... A gentleman of Hartford, Conn., has invented an electric revolution register to indicate the speed of engines or other machines by electricity. It is arranged with magnetic coils, armatures and magnets, which, with a series of gears, move a pointer on a dial in unison with a time pointer so that the falling off or gain of a single revolution is seen at once on the dial.

TELEGRAPHIC

.... A telegraph line is being constructed along the Great Northwest Central Railway in Manitoba.

.... The Mackey-Bennett Postal Telegraph Company have opened an office for business at Emporia, Kan., having work completed both from the east and the west to this point. This gives Emporia two distinctly independent lines east and west and across the ocean.

.... R. R. Dobell has petitioned the House of Commons to incorporate the Canada Cable Company, an organization which proposes to construct a new Atlantic cable from Great Britain to Canada. It is understood that Mr. Dobell will ask for a bonus as soon as the company is incorporated, but it is almost certain that the line will not be subsidized.

.... Judge Cole, in the U. S. District Court, at Boston, last Wednesday, ordered a decree for the complainant in three suits brought by the Attorney-General of Massachusetts to recover the sum of $45,000 from the Western Union Telegraph Company, which is the amount assessed upon the defendant company as a franchise tax for 1886, '87 and '88.

.... The certificate of the directors of the Commercial Union Telegraph Company, of Albany, that its capital had been increased from $200,000 to $300,000, has been filed with the Secretary of State at Albany, N. Y. The general routes are changed and extended, the points to be connected and designated are as follows: From Albany through Kingston, Rondout, Newburgh to New York City, with branch lines to Poughkeepsie and Pawling. The certificate is signed by Henry Russell, Edward J. Slattery, Charles E. Arnold, Henry L. Smith, Edgar Cotrell.

... The Worcester Telegraph Association held its annual meeting last week, at the office of the John Stetson Company, and elected the following officers: President, J. Walter Flagg; vice-president, W. E. W. Felt; secretary, Edward C. Fuller; treasurer, John E. Thomas; electrician, Arthur H. Evans; directors, A. H. Parker, A. L. Bennett and J. A. Corriveau. Four new members were admitted. The organization was formerly known as the West Side Telegraph Association, and has now been in existence two years. It has several miles of wire in the city, and looks forward to increased success. The members include gentlemen interested in telegraphy and electricity, who devote such leisure as they may desire to the association.

.... The Canadian Pacific Railway Company's line of telegraph was completed last week, and the Halifax office opened for business. The advent of the C. P. R. telegraph was hailed with delight, not only by the business community, but more especially by the government and the press. Heretofore all government official business has been under the control of the Western Union Telegraph Company, of New York, which, during the fisheries dispute between the Dominion Government and the United States, might have been a matter of serious concern. The press news supplied to the Maritime Province papers has also been compiled in Boston, making the newspapers dependent upon American sources for not only their European, but most of their Canadian news.

.... Against the assertion that underground conduits are useless, as so often made by telegraph and street railway managers, stands the experience Milwaukee made with the fire-alarm and police telegraph conduit. The same was placed underground about a year ago, and the experiment has proven successful in every particular. The lines worked without interruption, and not once have any repairs become necessary. The manholes were never opened, and from appearances it can be said that the wear and tear for one year is not perceptible at all. This observation is of importance regarding the movement to bring all the telegraph and telephone wires underground, and may serve as great encouragement to the advocates of underground conduits to push the matter.

* * The citizens of Independence, Ia., subscribed $10,000 in one day for an electric railway project.

* * Electric motor power is being extensively adopted in the manufacture of gloves by concerns at Gloversville, N. Y.

* * Salem's (Ohio) Electric Street Railway will be in operation by the 10th inst. Three cars will be used at that time.

* * The State Department is informed that the electrical exhibition to be held at Frankfort-on-the-Main, has been postponed until May 1, 1891.

* * The management of the electric railway systems of Davenport, Stillwater, Minn., and Dubuque, have been consolidated. The general office of the company will be located at Davenport, Ia., where the incorporators reside.

* * Mr. N. H. Edgerton has opened a shop and laboratory at 805 Sansome street, Philadelphia, for electrical experimenting. Mr Edgerton, the inventor of the motor of that name, is a gentleman of much experience in electrical work.

* * A number of prominent citizens of Champaign, Mo., have incorporated an electric railway company for $150,000. The plan is to run an electric road between here and Urbana, with branches on the principal streets in each town.

* * The Utica, N. Y., Belt Line Street Railway Company is gradually but surely preparing to make a change from horse power to electricity. It is fair to presume that the company will be in readiness to operate electric motor cars within a month at the farthest.

* * The new electric railway at Fort North, Texas, will be equipped with 15 cars, which were contracted for with the Thomson-Houston Electric Company, of Lynn, Mass. The cars are supplied with two 15 horse-power motors each, and will probably be running by April 15th.

* * The decision of the supreme court in favor of the electric railroad at Newport, R. I., and the dismissal of the bill brought by certain objectors, settles the most important question that has yet been raised in this case. The right of the city to authorize the laying and maintenance of poles as at present is affirmed.

* * The street railway of Rockford, Ill., has been purchased by Iowa capitalists, headed by R. N. Bayliss, of Des Moines, Iowa, president of the street railway of that city. The capital stock of the company here has been increased from $50,000 to $150,000, and the propelling power will be changed from horse power to electricity.

* * The Thomson-Houston Company has received an order for the complete equipment of 100 motor cars for the St. P. & Minn. Street Railway lines, and for 60 electric locomotives to be used between the two cities for regular train work. The business will amount to two millions of dollars or more during the next two or three years.

* * A comparison was recently made between a three horse-power electric motor and a four horse-power steam plant, and, including all expenses and excluding depreciation in apparatus, the cost of running the electric motor was 65 per cent. of what it was to run the steam plant, or, in other words, the saving in the use of the electric motor was 35 per cent. If the depreciation of apparatus for the time of trial was taken into consideration, it would have been in favor of the electric motor.

* * W. B. Knight, a well-known engineer, has secured a contract to construct an electric railway in Memphis, Tenn., and the work will begin at once. The system is to be 13 miles in length, and divided into three separate lines, extending south, east and north, from a common power house. There will be double tracks laid through all the city streets, while in the suburbs for the present only single tracks will be used. Only ten cars will be used at first, but the plant will have a capacity for double that number.

A New Universal Tin Shade.

The shade illustrated in this article is designed especially for use in mills, factories, machine shops, billiard rooms, and places where a more expensive porcelain or glass shade is liable to be broken or damaged. It is stamped out of a single piece of tin, painted a light green on top, having a bright tin under or reflecting surface. The corrugations help to diffuse the light evenly and give the shade a finish.

FIG. 1.

The No. 1 shade is designed especially for the Edison socket, which it fits perfectly without a holder, while the No. 2 shade fits any socket in the market, besides the Edison. There is a brass collar closely fitted around

FIG. 2.

the rim of the No. 2 shade, having adjusting screws arranged to securely fasten the shade to the socket.

These novelties are being introduced by the Central Electric Company, of Chicago.

A Reply to the Arguments of Mr. Perry in the Telephone-Electric Railway Case at Cincinnati.

TO THE EDITOR OF ELECTRICAL REVIEW:

The ELECTRICAL REVIEW of February 1, 1890, contains an argument purporting to have been made in behalf of the Telephone Company, by Mr. Nelson W. Perry, during the recent trial of the case of The City and Suburban Telegraph Company *vs.* The Mt. Auburn Inclined Plane Street Railway Company, before the Superior Court at Cincinnati, O. This argument contains several misleading statements that are calculated to create an erroneous impression upon the mind of the reader, and this to such an extent that I feel it necessary to make the same clear.

The Railway Company, who are the defendants in the suit and operate what has been termed a single trolley electric railway system, claimed in their opening statement, among other things, that the use of the rails as part of the circuit enabled them to obtain an increased tractive efficiency which prevented the slipping of the wheels on steep grades and under unfavorable conditions of the weather. This was denied point blank by the expert witnesses for the Telephone Company, who testified that the passage of current from wheel to rail or *vice versa* could have absolutely no effect in increasing the friction between the two surfaces. In order to demonstrate the truth of the Railway Company's claim, notwithstanding the assertions of the telephone electricians to the contrary, the apparatus referred to in Mr. Perry's article was set up and operated in court by the writer, who was called as a witness for the defense. This apparatus consisted of a light, polished, iron bar connected at one end to a spring balance, and resting upon two wheels that were rotated in unison by a cord and weight, the wheels forming the terminals of a circuit containing four cells of primary battery connected in series, and furnishing a total E. M. F. of about six volts.

With the small apparatus it was satisfactorily and conclusively shown that, whereas the constant pull upon the balance due to the normal friction between the wheels and bar, when the current was open, was but *one* ounce, the tractive pull exerted upon the same bar when the circuit was closed was *two* ounces, or an increase in traction of just 100 per cent. This experiment was repeated personally by his honor, Judge Taft, before whom the case was tried, and by others present. The current used was subsequently measured, and was found to vary somewhat on account of the rapid polarization of the battery, the mean strength indicated by the ampere meter being about 16 amperes. The total amount of electrical energy available during this experiment to produce the increased co-efficient of friction referred to was, therefore, about 96 watts, or only a fraction over one-eighth of one horse-power, and consequently *was not* and *could not be*, as stated by Mr. Perry, "in excess of that usually employed to operate a heavily loaded street car." I need scarcely add that if Mr. Perry will furnish four cells of battery that will do the work of operating a heavily loaded street car, he need not devote any further time to a discussion of the relative merits of single and double trolley railway systems.

In addition to the apparatus already described, there was placed in evidence the result of practical tests made with the same device upon a much larger scale, and, though these results have a most important bearing upon the point under consideration, they have apparently been entirely overlooked in the argument referred to. It may also be stated that during the demonstrations in the court room, no sparking at the points of contact was perceptible, except when the bar was purposely lifted from one or both of the wheels while current was flowing, and the microscopic roughening of the surface mentioned was probably the result of these interruptions.

For the purpose of illustrating some of the practical advantages incident to the employment of artificial tractive adhesion (such as that obtained when the track rails form one side of the circuit), and to compare these advantages with the conditions existing upon a road the cars of which depend for traction simply upon natural adhesion, the writer exhibited a model car running upon a track that could be elevated at one end to any desired grade up to 50 per cent. In this case the artificial adhesion or sliding friction between the wheels and rails was produced by temporarily magnetizing the wheels by the passage of current through magnetizing coils wound upon the driving axles of the car, the current being controlled, for convenience of manipulation, by means of a switch at one end of the track. With this model it was shown that artificial adhesion would not only enable a car to ascend much steeper grades than it could by natural adhesion alone, but that it could hold itself on a steep down grade (by applying a suitable braking agency) with a greater degree of safety than cars not provided with means for artificially increasing the adhesion between the wheels and rails. In the case of the model under consideration, the car, which, with the energizing circuit open, could not mount a 25 per cent. grade, readily ascended without slipping a grade of 50 per cent. when the circuit was closed. When the switch controlling the flow of current to the magnetizing coils was thrown open, the car instantly shot down this grade, but, to the great astonishment of the railway men present, was almost immediately arrested in its descent by again closing the switch, thus completely demonstrating the practical value of increased traction.

It was objected by counsel for the Telephone Company that this model did not represent the passage of current from the wheels into the rails, and that the magnetizing coils could be applied equally well and with the same effect to double trolley and secondary battery railway cars. The model, however, was not intended to represent, nor was its construction such as to permit of, the passage of a traction current between the wheels and rails, which latter had already been satisfactorily illustrated by the apparatus first exhibited, and it was for these reasons that the writer refused to permit the Telephone Company's experts to experiment with the model, and to make the changes they proposed.

It is self-evident from the evidence in the case that the advantages resulting from increased traction, as shown by the experiments made on the inclined track, are to a greater or less extent present in and incident to the operation of the single trolley road, and while the percentage of increase may perhaps not be as great as it could be made by means of an independent local current or separate traction-increasing device, such as those experimented with by the writer, yet it is sufficient to enable the cars to ascend grades which they could *not* surmount under similar conditions if the track return were dispensed with. Very respectfully,

ELIAS E. RIES.

Baltimore, Md., Jan. 31, 1890.

Cutting Ice by Electricity.

The familiar adage "Make hay while the sun shines" is full of significance to those engaged in securing the crop, and the importance of quick work is known to all, and hence the mowing machine, harvester, hay fork and wheel rake. No less important to ice men is the recent ice harvesting machinery invented by Mr. F. E. Kinsman, late president of the Electric Construction and Supply Company. This apparatus, consisting of an electric motor suitably mounted upon a pair of spurred wheels upon the inside of which is shown a ring gear, the motor armature shafts being extended at both ends carries pinions which engage with ring gear on inside of wheels for the purpose of propulsion. Upon said armature shafts are mounted extension knives or cutters of a suitable character for grooving the ice to any desired depth, also corrugates (not shown), which enable packers to place one cake upon another without

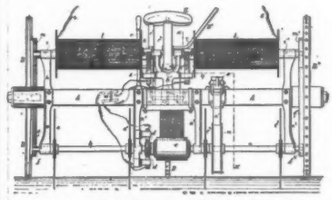


FIG. 1.—END VIEW OF ELECTRIC ICE CUTTER.

their sticking or pressing together in the house. These are keyed to the armature shaft and revolve with it. On machines designed for use in connection with a permanent or portable steam plant upon shore, there is a cable drum mounted upon the machine so that its shaft's ends bear pinions which engage with the ring gear with either a direct or reversible motion same as armature shaft, but of larger diameter. This drum or drums carries a small flat cable, which is paid out as the machine advances or taken up as it returns. The depth of the groove is regulated at will by an operator seated upon the machine, who can, by throwing forward a lever, lift the cutters clear of the ice without in the least interfering with the progress of the machine,

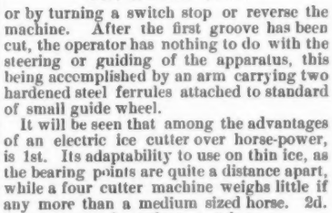


FIG. 2.—SIDE VIEW.

or by turning a switch stop or reverse the machine. After the first groove has been cut, the operator has nothing to do with the steering or guiding of the apparatus, this being accomplished by an arm carrying two hardened steel ferrules attached to standard of small guide wheel.

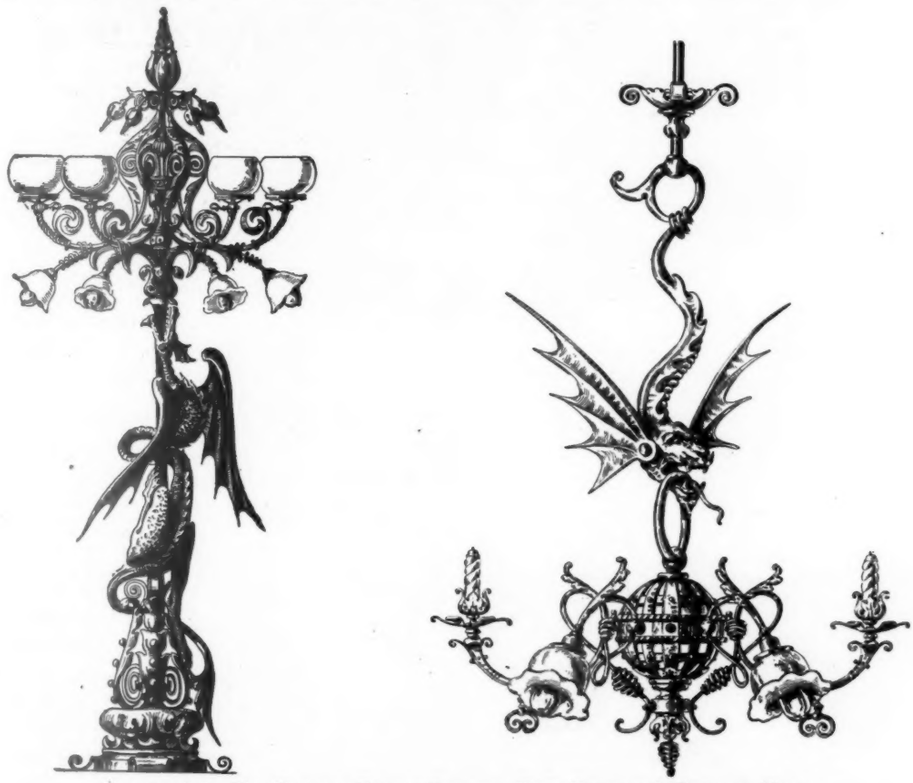
It will be seen that among the advantages of an electric ice cutter over horse-power, is 1st. Its adaptability to use on thin ice, as the bearing points are quite a distance apart, while a four cutter machine weighs little if any more than a medium sized horse. 2d. It cuts nearly through at one trip.

One man with a two knife cutter will perform the work of 25 horses, plow, men and leaders, at times and places where and when it is next to impossible to obtain them, especially in remote parts, in seasons like the present, which promises but a limited crop.

* * The East St. Louis and St. Louis Electric Railroad Company has obtained the signatures of the owners of a majority of the front feet on the streets through which it proposes to run its cars. The company is organized in two States, Missouri and Illinois, and the line that now runs so successfully over the big bridge is known as the St. Louis and East St. Louis Electric Railroad Company. The road will be about three miles long, with turnouts, and will run through Broadway, to the rock road, to Eighth street, to St. Clair avenue, to the National Stock Yards, and will cost, with the plant which is now in successful operation, about $90,000 per mile.

New Electric Fixture Designs.

In no department of electrical work is there the opportunity for artistic and pleasing display that there is to be found in the manufacture of electric fixtures. Philadelphia has long been noted for her work in this line, and the REVIEW is pleased to illustrate some of the new designs supplied by Messrs. Horn, Brannen & Forsythe, of North Broad street, Philadelphia. The larger design on this page is a combination fixture made of wrought iron, intended for suspending from the ceiling. The design is a striking one and is rapidly becoming popular. This company manufacture all their own wrought iron fixtures, and in their exhibit room have a number of very handsome designs. They recently supplied all the fixtures for the Carnegie Library, of Pittsburgh, which is lighted by the Westinghouse system, the fixtures all being made of wrought iron in a number of artistic shapes. The company has recently fitted up also two large boats, running between New York City and Albany.



FIGS. 1 AND 2.—NEW ELECTRIC FIXTURE DESIGNS.—HORN, BRANNEN & FORSYTHE, PHILA.

These boats are lighted by the United States Company's system of electric lighting, and were tastefully fitted up with electric fixtures by Messrs. Horn, Brannen & Forsythe.

Another strong design is illustrated on this page, and all the work of the company would indicate that their artist is a progressive and tasteful designer.

—— Two new central stations are now being installed with the Westinghouse alternating current system, one at Uxbridge, Mass., and the other at Gouverneur, N. Y. Both plants will have a capacity of 750 lights.

—— The Bedford, Pa., Electric Light Company, has re-elected old directors as follows: Frank Fletcher, Julius Simon, H. D. Tate, James F. Mickel, John O. Smith, L. B. Doty and Alex. King. Messrs. Harry O. Hafer, W. H. Bower and Joseph T. Alsip, were elected auditors to examine the company's accounts.

—— Recently the Brush Electrical Engineering Company, Limited, of London, gave a dinner at the Hotel Metropôle, to about 200 gentlemen interested in electrical matters. The occasion was the tenth anniversary of the formation of the company, and the guests included representatives of all branches of electrical science and manufacture.

Skirmishing Along the Lines.

The Cincinnati Electric Light Company and the Brush Electric Light Company, of Cincinnati, are bitter rivals. War has been declared on both sides.

Several weeks ago the Board of Public Affairs issued an order permitting the Cincinnati Electric Light Company to string wires on the poles of the Brush Company. It was while carrying out this order that the trouble arose.

One afternoon, last week, word was received at central police station that a small sized riot was on between the linemen of the rival companies. A sergeant was dispatched to the scene of trouble, and on his arrival beheld a crowd of about 1,000 people, who were watching for the coming attack. On the poles were a number of linemen armed with hatchets.

Declaring a truce, a parley ensued, which resulted in the sergeant placing two of the Brush men under arrest. The remainder retreated upward and took to the poles. Assistance arrived in the shape of two more officers, one of whom, Officer Mount (as his name might suggest), had formerly been a lineman. The Brush men were calmly surveying the battle from comfortable positions on the cross-arms. After Officer Mount's request to descend and be arrested had been refused, the active officer started up the pole as he used to when stringing wire. The crowd hooted and yelled, the Brush men turned pale, the policeman continued to "mount," and, finally, the belligerents gracefully followed down the poles in single file, and eight of them were taken in to await developments.

—— The public are beginning to recognize the superior value of the electric stocks of the foremost companies, and if the condition of some of the local light and railway companies are investigated, as may readily be done, it will be found that the bonds of these companies are well suited for investment. They are usually first mortgage bonds, well secured, and bearing six per cent. interest. The companies average 15 or 20 per cent. net earnings annually, and there is no class of securities on the market which offers better inducements to conservative investors, than is found in these bonds. This class of securities has recently become so popular, that there are firms who devote their entire attention to them, and they are able to give explicit information when it is desired.

—— Work has progressed at Topeka, Kan., rapidly in equipping the state house with electric wires; work in the hall of the House of Representatives is finished. The large central electrolier looks like an inverted chrysanthemum.

—— At a meeting of the Weston Illuminating Company, held at Boston, Mass., the following directors were elected: F. L. Higginson, president; A. Robeson, secretary and treasurer; Moses Williams, Charles Storrow, H. L. Higginson.

—— The Nashua, N. H., Heat, Light and Power Company finds its present electric light building much too small for its demands. The building was erected but four years ago, and the power has been several times increased. The new plant will be located on the gas house land, owned by the company, in Belvidere. It will be of brick, of greatly increased facilities, and will cost from $60,000 to $80,000. Work will be begun in the spring.

—— The Westinghouse Electric Company has shipped a 125-light arc dynamo, new arc light system, to New York City. The machine will run in connection with converters and the flat carbon lamp will be used.

—— The annual report of the Grand Rapids, Mich., Edison Light and Fuel Gas Company, shows capital stock, $150,000; paid in, $138,425; real estate, $30,653.71; personal estate, $152,816.23; debts, $55,-238.46; credits, $3,516.75; principal stockholders are Edison Electric Light Company, of New York, John R. Markle, E. W. Voig and Daniel McCoy.

—— An exchange says: The Huron South Dakota, electric lights outshine the Aberdeen lights. Those of Aberdeen can be seen 17 miles distinctly in clear weather. Huron lights are plainly visible at Pampus Grange, a distance of 23 miles. We have it from reliable business men at Leola, that the electric lights of Aberdeen can be plainly seen at Leola, 35 miles distant.

—— The Hudson Electric Light Company, Hudson, Mich., started its plant about the first of the month, under a 30 days' trial by the Schuyler Company, from whom the electrical machinery was purchased. With the exception of some slight delay owing to the blowing out of a hand-hole plate on the boiler, everything has been running with perfect satisfaction, and the people are well pleased.

ELECTRIC LIGHT NEWS

—— Catasauqua, Pa., is to have an electric light plant valued at $30,000. Hamburg is next on the list.

—— Pocatello, Idaho, now has an electric light plant. There are 400 lamps in use, and they give general satisfaction.

—— The electric light company has begun work in earnest, and in 15 days Griffin, Ga., will have lighted streets.

—— Biddeford, Me., has given the electric light company there a 20-year contract for 45 lights, at $100 a year, per light.

—— A company has been formed at Ogden, Utah, with a capital stock of $30,000, to put in an electric light plant at that place.

—— An electric light plant will be installed in the California State Prison, at Folsom. The waters of the American River will be utilized for power.

—— At Denver, Col., a resolution has been introduced authorizing the city treasurer to advertise for bids for a three years' contract for 400 arc lights.

—— After a long debate in the city council, it was decided that Fort Worth, Texas, was to have electric light. The Wood arc and Edison incandescent systems were adopted.

—— The Baltimore and Ohio Railroad will put up an electric light plant at Glenwood, and illuminate all their stations between Braddock and Pittsburgh with electricity.

—— The Pike's Peak Railway, reaching from Manitou to the top of the Peak, over 14,000 feet high, is to be lighted by electricity from one end to the other, a distance of about ten miles.

—— At a meeting of the Columbia, Pa., Electric Light Company, held at the office of its president, Dr. Alex. Craig, on last Thursday, the old board of directors were elected and the following officers: President, Dr. Alex. Craig; secretary and treasurer, S. Atlee Bockius; executive committee, J. A. Minich, E. B. Eckman, John Fleming.

—— The electric light is becoming recognized as one of the best paying investments in this country. An electric lighting company in Pennsylvania, as an instance of good profits, has 40 arc lights and 1,000 incandescents, the latter having been lately increased by another 750. From the time it started, some three years ago, the company has paid an annual dividend of 17 per cent. to the shareholders.

—— The electric light company, of East St. Louis, Mo., finished the work of putting up the poles in the city proper last week. Work on the island will be commenced this week. The railroad switch to the company's plant, which had greatly retarded the preparations to light the city, is now finished. The engines are already in position and the other machinery is ready to be unloaded from the cars. It will be put up at once. It is thought that the lights will be burning by the middle of next month.

—— Mr. Eugene T. Lynch, Jr., has contracted to light the city of Newberne, N. C., with electric lights. His contract not only covers the exclusive franchise for lighting the city, but also includes the operation and construction of a street railway system. The plant will consist of two 100 horse-power boilers, two high speed engines, a 50 arc light dynamo and lamps, and about 1,500 sixteen candle-power lamps, a large number of which have already been subscribed for. This makes the fourth central station contract that Mr. Lynch has secured within the last 60 days, and he intends to make the entire plant a model one. The site for the station gives great facilities for the handling of coal, either by railroad or water transportation.

The National Electric Manufacturing Company's System of Long Distance Lighting.

Not quite a year ago, Mr. Walter K. Freeman, who was at the time with the Fort Wayne Jenney Electric Light Company, conceived the idea of organizing a company in the Northwest, for the manufacture of his alternating system of electric lighting. As a result of his efforts, the National Company was organized in Eau Claire, Wis. The business of the company has been successful from the start.

The designing of the various pieces of the apparatus, and the electrical determination for the same was done so carefully that the very first dynamo was almost perfect, and has been running daily in a large manufacturing establishment in their city.

The new company has been especially fortunate in its competitions with the older concerns in the long distance field.

The first plant was installed on the first day of February, 1889, and from that date up to September 1st, the installations have amounted to more than 17,000 sixteen candle-power lamps, with a dynamo capacity for 22,000 lights. New orders filled since and on hand amount to some 25,000 lights.

The inventor of this system first exhibited his apparatus, which involves the well-known principles of the alternating or transformer system, in Racine, Wis., in 1877.

The accompanying illustrations show some of the principal features of the system. In Figure 1 is shown one of their alternating dynamos. The machine embodies many features of utility which it is claimed are not shared by other makes of that class of apparatus. It will be observed that the dynamo is a very compact and symmetrical piece of machinery. The type of other alternating dynamos is approximately followed, the differences being chiefly in details.

The armature used is composed of a cast alloy supporting hub, with outward projecting arms paralleled to the shaft on the carrier; at the end of each arm a rim is cast, so shaped as to receive and hold in place the sectional plates, which are laminated and arranged so as to allow ventilation of the armature.

The armature of the exciter is of the Gramme type. While the dynamo closely follows the conventional alternating machine in design, the exciting apparatus is a type peculiar to the Freeman system. The exciter is made separately, or can be attached to the dynamo. A belt tightener is part of the exciter outfit.

A novel lubricating device is used on the dynamo. It is arranged to distribute the oil evenly on the journal, and the drip is carried to a reservoir under the box.

The manufacturers state that the transformers, which are of the reversed Gramme ring pattern, yield an efficiency of 96 per cent.

The system is very complete, and embraces many new and useful features.

The Payen Accumulator.

M. Payen has recently designed an accumulator differing in some particulars from those previously manufactured, says *Engineering*. It is of the Planté type. Melted chloride of lead is mixed with asbestos and cast into brass moulds. On cooling, a plate of crystallized lead chloride is obtained, enclosed in a network of asbestos. The formation of the plates is accomplished in two operations, in the first of which the chloride is transformed into a mass of porous metallic lead. This is done by decomposing water with the plate as the cathode, and a sheet of metallic lead as the anode. This latter plate is in the operation transformed into the chloride, which is used in preparing a new plate. The process is completed by forming the plate of porous lead, obtained as described above, by the ordinary methods.

—— The petition of the taxpayers of Newton, Mass., that the city hall be lighted by electricity is one worthy of favorable action by the city government, for the new light is much better for places of entertainment.

Copper Production and Consumption.

Some interesting figures regarding the production and consumption of copper are given in a recent issue of the *Engineering and Mining Journal*. Consumption declined from 140,000,000 pounds in 1887, to 112,000,000 pounds in 1888, by reason of the French syndicate contracts. With the collapse of the syndicate in March, 1889, the stocks of copper in this country amounted to no less than 70,000,000 pounds, nearly one-half Lake Superior. From the collapse, consumption increased at a marvellous rate to the close of 1889.

The total production of copper in this country, including that produced from imported ores in 1889, was 241,830,000 pounds, or only about 9,000,000 pounds more than in 1888, and added to the stock on hand at the beginning of the year, it left available no less than 316,830,000 pounds. Of this only about 73,000,000 pounds were exported, the figures being based on official returns for 11 months.

The stock of copper on hand at the end of 1889, was 65,000,000 pounds, against 75,000,000 at the end of 1888. Exports and stock on hand deducted from the available supply gives consumption, which reached the enormous total of nearly 179,000,000 pounds. Lake Superior mines produced in 1889, 86,630,000 pounds, against 86,584,124 for 1888, and 75,471,890 in 1887.

Arizona produced in 1889, 32,300,000 pounds, against 32,516,293 in 1888, and 17,790,000 in 1887. Montana produced in 1889, 104,200,000 pounds, against 98,500,000 in 1888, and 78,700,000 in 1887.

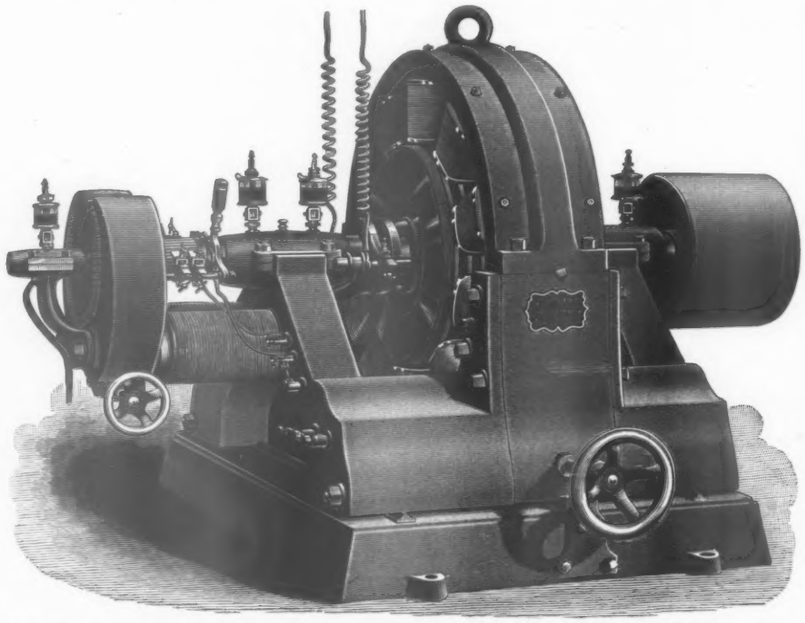


FIG. 1.—DYNAMO OF THE FREEMAN ALTERNATING SYSTEM, OWNED BY THE NATIONAL ELECTRIC COMPANY, EAU CLAIRE, WIS.

* * The enormous undertaking by which sufficient power is to be created to move the largest number of West End electric cars, is the leading mechanical feature of Boston at the present moment. It is on the site of the old Hinckley Locomotive Works, and it is in contemplation to produce there 13,000 horse-power. The masonry is formidable in its solidity and strength, and the chimney, when constructed, to rest upon it will rise 50 feet higher than the monument at Bunker Hill. It is claimed that 300 tons of coal per day will be required to develop the maximum of electric force.

* * The prospects are very flattering for the early substitution of electricity for mule power on the lines of the Union Street Railway, of Burlington, Ia. Mr. Putnam, of Boston, one of the largest owners of the road, is in the East, together with Mr. Horn, an expert electrician with the Thomson-Houston Company.

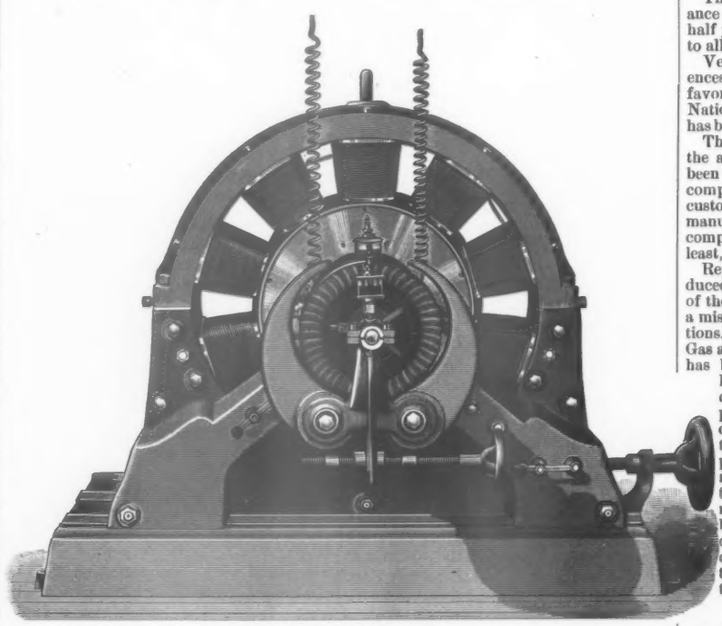


FIG. 2.—END VIEW OF SAME.

Withdraws from the Fixture Association.

The Mitchell-Vance Company, of New York, is widely known as one of the most extensive manufacturers of electric light and gas fixtures in this country. This company announces, under date of January 20, that it has withdrawn from the Gas and Electric Light Fixture Manufacturers' Association. The reasons are set forth in the following circular:

Since the organization, in July last, of the association formed to promote the best interests of manufacturers and dealers, the undersigned have striven with their utmost ability to bring harmony into the association, and used all their efforts to advance the welfare of the trade, whether it concerned the making and selling of goods or in promoting the relations of our customers with the association.

Therefore, we had hoped for its continuance upon a similar basis to that of the past half year, as it had proved so advantageous to all.

Very much to our regret we found influences being exerted in the association in favor of a trust, and the formation of a National Gas and Electric Fixture Company has been the result.

The terms of the agreement under which the association was originally formed have been violated to further the interests of this company, which has sent circulars to our customers stating that goods ordered from manufacturers must be sent through the company, a method of business, to say the least, complicated and unnecessary.

Representatives of our company were induced to attend some of the early meetings of the incorporators of this company under a misunderstanding of its objects and intentions. We have no interest in the National Gas and Electric Fixture Company, and it has been requested to withdraw from its letterheads and other papers the name of our Mr. Mitchell wherever it appears. We naturally prefer to keep control of our own business, and with the assistance of our customers, we propose to prosecute it in a legitimate manner, supplying a full line of goods to meet all requirements, the artistic merit, quality and finish of which will be fully maintained at prices as low as consistent with a living profit, taking care, as always heretofore, to protect the trade when supplying our goods to their customers.

* * The gentlemen of Lawrence, Mass., who are interested in the new street railway, have formed themselves into an organization, and the necessary legal steps will soon be taken towards forming an organization. Its name will be the "Lawrence and Methuen Street Railway Company." It is proposed, too, if the project proves a success, to construct an electric railway from this city to Andover. The Thomson-Houston Electric Company is taking an interest in this road, and if they take hold of it they want a continuous line from Andover to Methuen.

Electrical News From London.

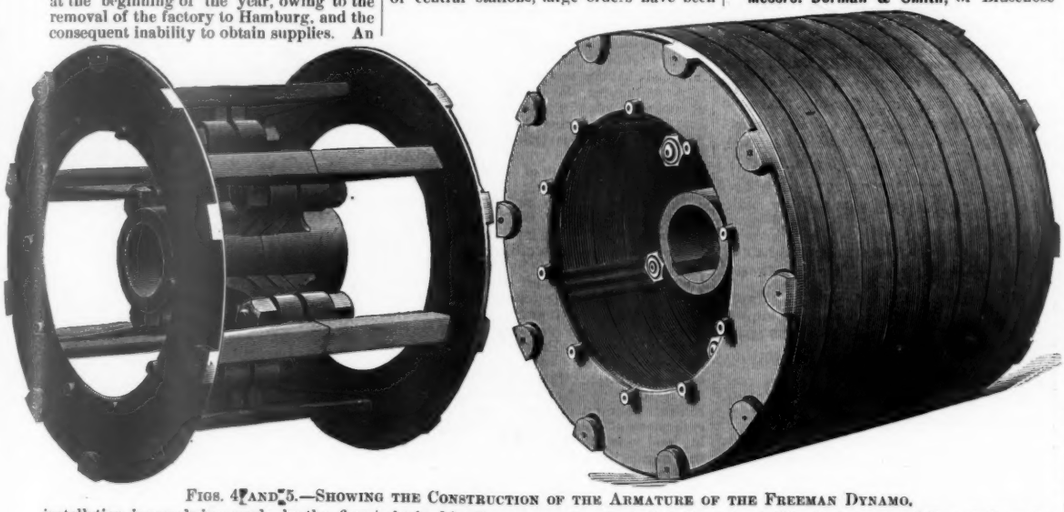
WHAT OUR ENGLISH BRETHREN ARE DOING IN ELECTRICAL CIRCLES.

A VERY COMPREHENSIVE PRESENTATION BY THE "REVIEW'S" SPECIAL CORRESPONDENT.

The Beginning of a new year is undoubtedly the fittest time for considering the progress made in electric lighting, and to obtain a proper understanding of what has been done, the easiest means will be the giving a short account of the working of some of the more prominent firms in this country, and such will, I am sure, be of remarkable interest to your readers. In order to prevent any suspicion of favoritism, all the firms I mention are given in alphabetical order.

The Bernstein Electric Lamp Company, Limited, of 2 Marlborough Mansions, Victoria street, Westminster, the owners of the Bernstein electric lighting system, report that their series system has made sufficient progress in the latter portion of the year to counteract the heavy business losses sustained at the beginning of the year, owing to the removal of the factory to Hamburg, and the consequent inability to obtain supplies. An installation is now being made by the firm in Italy, in which the series system is replacing the alternating transformer system.

FIG. 3.—COIL FOR POLE PIECE OF FREEMAN DYNAMO.



FIGS. 4 AND 5.—SHOWING THE CONSTRUCTION OF THE ARMATURE OF THE FREEMAN DYNAMO.

Messrs. Bourne & Son, of Derby, have had a busy year in their manufacture of stoneware for electrical appliances, and insulators for electric light, telegraphic and mining signals. There has also been an enormous demand for the fluid oil insulators, manufactured for the patentees, Messrs. Johnson & Phillips, of Charlton, Kent, and Union Court, Old Broad street. For the present year, very large orders for the company's products are expected from the Postal Telegraph Department.

The Callender's Bitumen Telegraph and Waterproof Company's chief work for the year has been in connection with the underground mains for electric lighting. Several large contracts have been carried out, from the excavations and construction of the protecting conduit for the cables, to the manufacture and laying down complete of the cables themselves, with all service and bodies forming complete distributing network. The most important of these contracts was at Liverpool, a complete network being laid out through nearly all of the business portion of the city, and from which many thousands of lights are already being supplied. The work was done for the Liverpool Electric Supply Company, Limited, and is very greatly in advance in extent of any system in operation in England. Among other contracts were those for the Metropolitan Electric Supply Company, Limited; Messrs. A. and T. Gatti, and the Chelsea Electricity Supply Company, Limited. A considerable amount of work has also been done by this firm in the supplying the well-known yarn, bitumen and lead sheathed cables for the navy, the admiralty contracts having been held by Messrs. Callender for the past two years.

Messrs. Chamberlain & Hookham, of Birmingham, who have prefected and patented an arrangement of intermediate magnets for securing a constant lead speed and potential in dynamos and motors, have been principally engaged in the manufacture of dynamos, but have also made several important installations. The firm have further improved Hookham's patent electricity meter for continuous currents, and are arranging and will shortly put upon the market for alternating currents also.

Messrs. Crompton & Company, Limited, have carried out the whole of the contract work for the Kensington & Knightsbridge Company, including erection and part equipment of two central stations, each of which when complete will supply 130,000 ten candle-power lamps. These two stations are on the battery transformer system. At Chelmsford a central station for lighting the town is just on completion on the alternating transformer system. At Northampton and at Swansea orders have just been secured and central stations commenced on the battery transformer system. A central station is about to be commenced for the Westminster Electric Supply Corporation. In addition to contracts for complete supply of central stations, large orders have been obtained by the company for plant of similar nature for Central Argentine Railway, the Gothenburg central station, the Liverpool Electric Supply Company, and for the Crompton Electric Supply Company, of Australia. Among a considerable quantity of depositing and metallurgical plant manufactured, may be mentioned a large dynamo, 2,500 amperes and 60 volts. In the Paris Exposition lighting Messrs. Crompton took a large share, including the large and small arc lamps, over the English, American and Belgium sections of the Galerie des Machines. They were the only English firm joining the Paris syndicate for the lighting, and received a gold medal. Several sets of plant have been supplied for the English and Dutch admiralty. Eleven steamships have been fitted complete, and steam dynamos have been supplied for the White Star ships "Teutonic" and "Majestic." The two last are probably the lowest speed direct driven sets ever constructed, the actual running speed being 170 revolutions for 110 volt lamps. In addition, Messrs. Crompton & Company have fitted up 98 installations, including the mansions of Sir Andrew Fairbairn, Sir Horace Davey, Sir Frederick Bramwell, etc., the total number of lamps being upwards of 11,500.

Messrs. Dorman & Smith, of Brasenose street, Manchester, report full work throughout the year, and although the factory accommodation was double last spring, a still further extension is now in contemplation. Central stations work and private installations throughout the country have shown enormous increase, and in the ship building line the demand for fittings has been unprecedented and is still continuing. The shipping trade has very much improved, principally with Australia, Spain, Holland, China and South America. The collieries are generally taking to electric lighting, and in use in the railways advance is also shown. The increased business has necessitated the opening of a branch office in London.

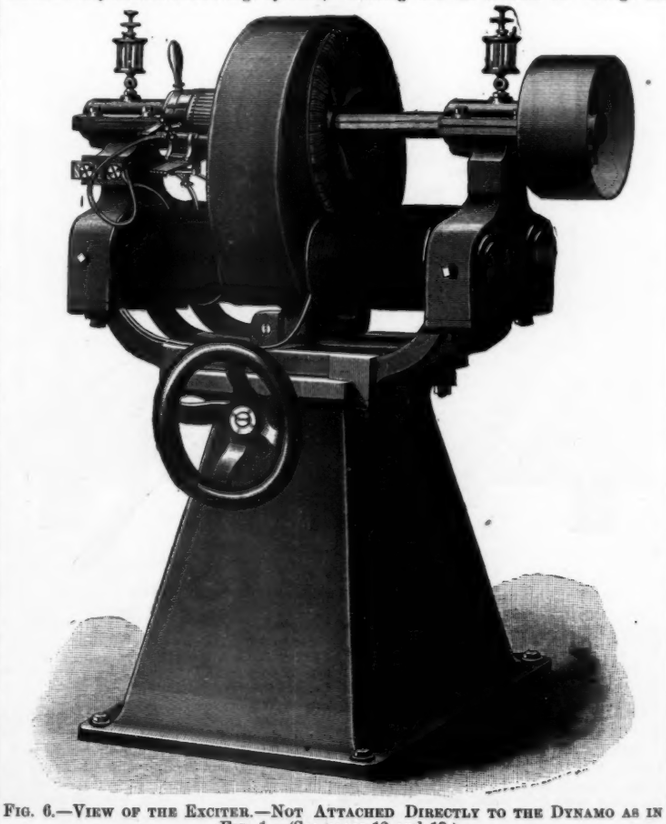


FIG. 6.—VIEW OF THE EXCITER.—NOT ATTACHED DIRECTLY TO THE DYNAMO AS IN FIG. 1.—(See pages 12 and 13.)

Messrs. Drake & Gorham, of 2 Princes Mansions, Westminster, have also shown such great progress in their business as to oblige a considerable extension of their offices. Generating plant for central stations has been one of the chief departments, but their experience has shown that the cost of a complete installation, if only medium size, is greatly below the charges made by the central station supply companies. As a motive power for pumping and driving electric hoists, electricity has been very successfully employed, and attention may be called to the electric hoist at the Bank of England, which is in daily use for conveyance of passengers and bullion. Major Cardew's patents have been purchased, including the well known "Cardew" volt meter and the "earthing device" obviating all danger from high tension alternating system. In installation work the Bank of England has been completed by the addition of two 9 horse-power gas engines to the existing 500 light steam plant; the Prudential Assurance Company installation, now numbering 3,500 lights; Batsford Park, 300 lights, and the Inner Temple, where a 300 light steam plant has just been started. The offices of the Provident Association and the African Bank, are fitted with gas engines and plant complete, and wiring contracts for central stations have been executed for J. Martin, Esq; Cuthbert Quilter, Esq., and many others. A department has been organized for foreign contracts, amongst which attention may be called to the Hotel Metropole, Sydney (800 lights), which is under contract for completion by the end of the year.

Messrs. John Davis & Son, of All Saints Works, Derby, report heavy business throughout the past year, including installations with accumulators, at collieries, country houses, foundries, etc. A central supply station was started in Derby early in 1889 and has worked with complete success. There is a total capacity of about 500 ten candle-power lamps, and the consumers are charged by meter on a sliding scale of 1s. to 8d per Board of Trade unit. The mains are carried overhead by insulating fasteners to copper bearers. Among recent installations are two pits for the Clay Cross Company, in which the plant is arranged for pumping as well as lighting; the Cossall Colliery, Tekeston; Masson Works, Derby, and a colliery for Messrs. Barber, Walker & Company, all being lit above as well as below ground. An extensive plant has also been despatched for the Cerro de Pasco Gold Fields, Transvaal. The protection to the lamps against accidental breakage, dust and dirt, which Messrs. Davis' experience found necessary, and which resulted in their manufacture of protector dust-proof fittings for incandescent lamps, has now been extensively adopted by other firms.

The General Electric Company, of Manchester, and Queen Victoria street, London, while complaining of the non-realization of their expectations for winter business owing to the fact of their customers, comprising all the principal electric light contractors, being unable to fulfil their calls owing to the backward condition of central stations in London and the Provinces, acknowledge the great increase in the sale of their standard articles and specialties such as Dr. Aron's electricity meters, apostle carbons and glassware designs. The increased business obliged the enlarging of their manufacturing premises as well as the warehouses and offices. In the factory at Manchester new machinery has been put in and employment is now given to over 300 men. Many new manufactures have been added to their list, such as ammeters and voltmeters, arc lamps and telegraph materials, and there has been a large increase in output of switches, cut-outs, ceiling-roses and general fittings. The commodious and very prominent building in Queen Victoria street, London, must have greatly assisted in the business progress of the firm last year.

Messrs. Johnson & Phillips, of Charlton, Kent, and Union Court, Old Broad street, London, have only to report increased work in all departments. The principal work has, of course, been electric lighting, and Kapp alternating current plants are just being completed for three central stations, the Metropolitan Company in London, another at Keswick, and the last for Hong Kong. The orders for the "Brockie Pell" arc lamps have been remarkably increased, and, as they come from all parts of the world, show the high estimation in which it is held. One of the largest installations of these lamps is at the General Post Office, London, where 76 are to be placed in the sorting rooms, and they are also to be used for the lighting of the Hong Kong streets. There has been great demand, also, for the patent liquid insulator for overhead electric

(Continued on page 12.)

KINDRED INTERESTS

The La Grande Edison Electric Company, of La Grande, Oregon, have received a 100 horse-power steam plant from the Ball Engine Company, of Erie, Pa. This plant was put in by the North Western Electrical Supply and Construction Company, of Seattle, Wash.

H. A. Rogers' well-known house, located at 19 John street, New York, handles everything of a known high quality in the way of general manufacturing and electrical supplies, and has had many years of dealing with the leading railroads and manufacturers of the country. Those needing anything in his line will find it greatly to their advantage to let him know about it.

Messrs. Queen & Company, the well-known makers and importers of electrical test instruments, report increasing and encouraging sales of their large resistance boxes. A megohm box of special pattern, with all the metal portions mounted on corrugated pillars, for most effective insulation, has just been brought out by them. Their magnet vane instruments, which were recently described in these columns, are now being put upon the market. The Brush Electric Company, of New York, purchased 19 of these instruments for station work during the summer, and have recently taken six more for their new plant in Minneapolis.

The Thomson-Houston Electric Company reports the following sales of incandescent apparatus to central stations: Franklin, Tenn., 300; Northampton, Mass., 650; Chatham, N.Y., 650; Beverly, Mass., 650; Great Falls, N. H., 1,300; Punxsutawney, Pa., 650; Sandy Hill, N.Y., 650; Petaluma, Cal., 650; Muscatine, Iowa, 650; Battle Creek, Mich., 650; Langhorne, Pa., 500; Belfast, Me., 300; Auburn, N.Y., 1,300; Meriden, Conn., 1,300; Paris, Ky., 1,300; Long Branch, N.Y., 650; Jacksonville, Fla., 650; Wallace, Idaho, 650; Millbury, Mass., 650; Brandon, Vt., 650; Butte, Mont., 650; Springfield, Ill., 650; Fresno, Cal., 650; Nashville, Tenn., 2,600; Ann Arbor, Mich., 650; Watsonville, Cal., 300; Mt. Clemens, Mich., 650; Bozeman, Mont., 500; Spokane Falls, Wash, 300; Great Falls, Mont., 650.

The Thomson-Houston Electric Company reports the following sales of arc and incandescent apparatus for isolated plants: Maryland Pavement Co., Baltimore, Md., 9 arc; Alliance Street Railway Co., Alliance, O., 50 arc; Philadelphia & Reading Coal & Iron Co., Pottsville, Pa., 30 arc; St. Paul Foundry Co., St. Paul, Minn., 9 arc; Mayfield Woolen Mills, Mayfield, Ky., 200 inc.; Western Kentucky Lunatic Asylum, Hopkinsville, Ky., 300 inc.; W. Russell & Co., Bellows Falls, Vt., 50 inc.; L. C. Bass Manufacturing Co., Guilford, Me., 100 inc.; Portland Steam Packet Co., Portland, Me., 400 inc.; Wayside Knitting Co., Troy, N. Y., 200 inc; Carrollton Furniture Co., Carrollton, Ky., 150 inc.; Morgan Envelope Co., Springfield, Mass., 100 inc.; Cambridge Training School, Cambridge, Mass., 200 inc.; American Net & Wire Co., Cambridge, Mass., 200 inc.

The Standard Underground Cable Company held a meeting of the stockholders in Pittsburgh, January 23d, and a meeting of directors on the succeeding day. All the old officers were re-elected, viz., George Westinghouse, Jr., president; C. H. Jackson, vice-president and general manager; John H. Dalzell, treasurer; J. W. Marsh, secretary; Elmer L. White, auditor and assistant treasurer. The following were elected directors: George Westinghouse, Jr., Robert J. Pitcan, Caleb H. Jackson, Mark W. Watson, John H. Dalzell, Joseph W. Marsh, Henry Snyder. An extremely favorable report of the year's business was rendered, indicating a net profit of 11 per cent. on the par value of the capital stock. The company starts upon the new year with orders in hand aggregating nearly $150,000. A dividend is announced for April 1st.

The Okonite Company, N. Y., since its establishment, a few years ago, shows what enterprise, pluck and perseverance, will do for the business man handling a good article. The popularity of the Okonite insulated wires and cables and also the Candee aerial wire and Manson protecting tape, made by this company, has been achieved on its merits.

The Fishkill-Corliss Horizontal Engine, built by the Fishkill Landing Machine Company, Fishkill-on-the-Hudson, N. Y., bears a good record for efficiency, economy and durability, due to the enterprise of the manufacturers. It is fast becoming widely known. The improved form of this engine, recently put upon the market, is well adapted for electric light plants.

Root's New Water Tube Steam Boiler, manufactured by the Abendroth & Root Manufacturing Company, 28 Cliff street, New York, is growing popular for power purposes in electric lighting stations. It is especially well suited for such work, and no better proof of this is needed than the fact that the electric light companies of Cincinnati, Louisville, Columbus, St. Paul, Detroit, Philadelphia and Jersey City, have been using this boiler for some time, and with the most gratifying results. A rapid steam generator, easily and quickly cleaned or repaired, economical in the use of fuel, and absolutely safe from explosion.

GENERAL NOTES.

The Western Union Telegraph Company, at Alliance, Ohio, is erecting a new building for railroad and general public service.

The Southern Bell Telephone Company has just completed a trunk line of 50 miles, connecting Huntsville, Ala., with Scotboro, using long distance instruments.

It is stated that ten men with drills operated by electricity, can take out as much ore and tunnel as far as 100 men with picks, shovels and blasting materials, besides which the buildings can be lighted, and a great saving on insurance and oil be made thereby.

The plans for the Bell Telephone Company's building, at Hamilton, Canada, have been finished by Mr. Balfour, and were sent to Montreal for ratification. The plans show a handsome brick building, in the Romanesque style, pointed with Credit Valley sandstone. It will be two stories, with a high basement. The basement, above ground, is built of Credit Valley sandstone. The two fronts on Hughson and Jackson streets will be of pressed brick with terra cotta trimmings. The structure will be fireproof, with iron joists, and will be 70x69 feet.

ELECTRICAL NEWS FROM LONDON.

(*Continued from page* 11.)

light wires, but it has been little taken up as yet by the telephone companies, to whom it ought to prove of great value.

Messrs. Immisch & Company, of Malden Works, Prince of Wales Road, London, N. W., report considerable progress in general lighting and installation work, having more than doubled the output for preceding 12 months, as well as great success with the fleet of electric launches on the upper reaches of the River Thames, and which it is intended to increase both in number of stations as well as launches for next season. At the present time there are five stations, four of which are floating and one stationary at the headquarters, Platt's Eyst, Hampton. In connection with the Electric Traction Company, Messrs. Immisch & Company have been running for the last seven months self-contained tramcars on the North Metropolitan lines between Barking and Canning Town, and since the end of November last, when the horses were withdrawn, the service of five cars has depended entirely upon electricity. The average mileage per car has been 60 miles a day, and the schedule time has been kept within about two per cent. According to the engineer's report, the Electrical Power Storage Company's plates are standing the rough usage much better than was expected; the chief difficulty experienced being due to faulty burning of the lugs to the cross bars. The cells having now been in use upwards of seven months, the figures obtained are of commercial value in estimating the probable cost of electric traction by accumulator cars. After carefully considering the figures, the Electric Traction Company are satisfied their original estimate of $4\frac{1}{2}d.$ per car mile is well within the mark.

The Laing, Wharton and Down Construction Syndicate, of New Bond Street, London, W., can evidence the increase in its operations since the division of the business at the beginning of last year, by the fact that in the 12 months their staff has been tripled. In no company have operations been upon a larger scale, and among the installations carried out by the syndicate have been the extension of the St. Pancras terminus of the Midland Railway Company; Bradford station, on the same railway line; Deptford Central station, the Railway Clearing House; central station plants at Exeter and Bath; extensions at Taunton, Waterford and Reading, and most successful temporary work at the Birmingham exhibition, which gained a gold medal, and the sea front at Portsmouth for the Naval Review. The Okonite insulated wires and cables for which a gold medal was obtained at the Paris Exhibition last year, have appointed the Laing, Wharton and Down Syndicate as their European agents, and the success experience has shown in the United States for the okonite material, gives every assurance of a similar result in this country, and there is no doubt the next few months will show an enormous increase in the amount of business done and amply repay the enterprising firm who have taken up the agency.

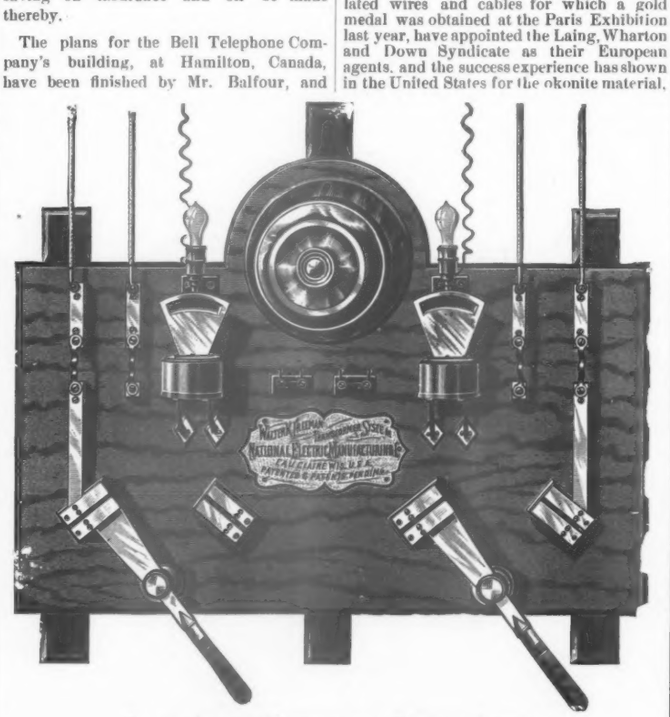


FIG. 7.—STATION SWITCHBOARD.—FREEMAN SYSTEM.

Messrs. Laurence, Paris & Scott have carried out some large orders during the year, but on the whole found business rather quiet. At the Birmingham Electrical Exhibition the firm was well represented, and were awarded the only special prize for dynamos and motors, a gold medal. Several patents have been taken out during the year, an instantaneous fuse, a system of laying underground mains, and also a meter for the more accurate measurement of small and large currents, and for which great reliability and cheapness is claimed.

The Manchester Edison-Swan Company report a most satisfactory condition of affairs, and as showing the progress made by electric lighting in the district, it may be mentioned the company have supplied 40,000 incandescent lamps. At the beginning of the year a central station on the low tension system was completed at St. John's, Newfoundland, and the houses of the Assembly, the government house and other buildings were lighted. Large installations have been put up for, amongst others, The Union Mill Company, Rochdale; Ainsworth Bros., Bolton; Textile Mill Company, Oldham; J. Mandleberg & Company, Pendleton; J. & J. Mellor, Bury; Messrs. Cannington, Shaw & Company, etc. The firm have also taken in hand the extensive premises of the Bolton-Cooper Syndicate, the installation at Castle Mona, Douglas, Isle of Man, to which I referred at some length in a former letter, and the pier of Llandudho. Installations are at present in progress for Messrs. Calvert & Company, the Kellner-Partington Wood Pulp Company, the Combatore Mill Company, Messrs. Langdale & Company, Messrs. Fletcher, Burrows & Company, Atherton, and others.

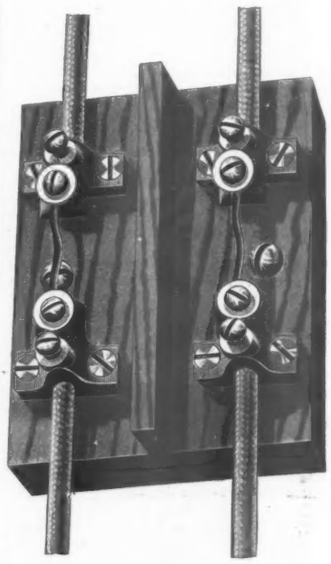


FIG. 8.—FUSE BLOCK FOR WIRE ENTERING BUILDING.

Messrs. Paterson & Cooper, of European Works, Pownall Road, Dalston, show enormous increase during the last year in the amount of business done, both as regards the number of machines sent out and the average size. For ship lighting a larger number of machines have been supplied, both rope driven and direct running. Among the more important installations carried out were those at the Albert Institute, Dundee; the Pentardame Tin Plate Works, South Wales; the Overton Paper Mills, Greenock; Messrs. J. & B. Stephenson's bakeries at Battersea, and the wharf of the Dundee, Perth, and London Shipping Company, at Wapping. There is more work under order than at the commencement of any previous year.

The Phosphor Bronze Company have had such great demand for the patent silicum bronze electrical wire, as to be obliged to double the plant at their rolling mills in Birmingham. Orders are increasing every month and the old heavy and most dangerous overhead iron, steel and copper wires, are being replaced by the new patent electrical wire, and which is acknowledged generally to be the most reliable for overhead use and is being adopted by all the leading telephone companies throughout the world. The Phosphor Bronze Company is also very busy in phosphor bronze ingots, castings, rods and sheets for electrical purposes, and also in white anti-friction metals.

Messrs. Ransomes, Sims & Jefferies, of Orwell Works, Ipswich and Gracechurch street, London, are full of orders for their well-known engines for electric light work and other purposes.

Mr. R. L. B. Rathbone must also have shared in the good results of the last year, as he also announces the fitting up of larger and more convenient workshops for the manufacture of his artistic brass and copper domestic, shipping and office fittings.

I shall complete this review in another letter in your next issue.

CHARLES FFRENCH.

London, Eng., Jan. 15, 1890.

The Control of Electricity.

[From the New York *Times*.]

The use of electric currents for lighting purposes must be put by law under such restriction and supervision as to insure safety, and should not be allowed to continue on any other condition.

And not only the public safety, but the public's convenience, its right to enjoy the use of the electric light under safe conditions, must be recognized and provided for.

We are not going permanently to put up with the inferior light of gas and oil simply because the corporations have been selfish, and our public servants ignorant, inefficient

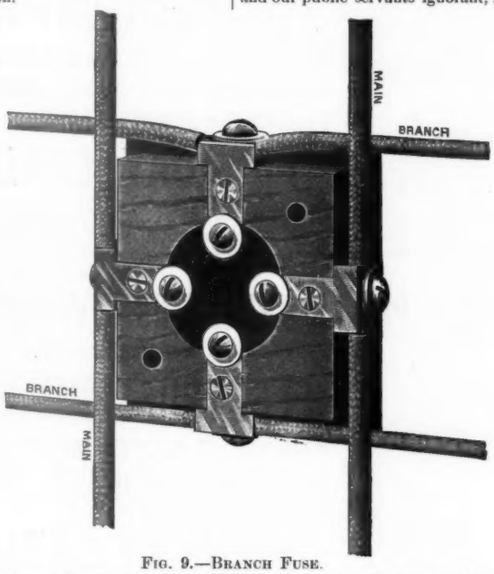


FIG. 9.—BRANCH FUSE.

It cannot be done off-hand by a parcel of politicians.

It must be done after careful inquiry and by methods dictated at once by a knowledge of what is required, and by a higher regard for public safety than for corporate profits.

or corrupt. To cut down and remove the dangerous poles and wires is only half the remedy. It is time now to take thought of the recreative stage of the work, how we may provide safer and better appliances for electric lighting.

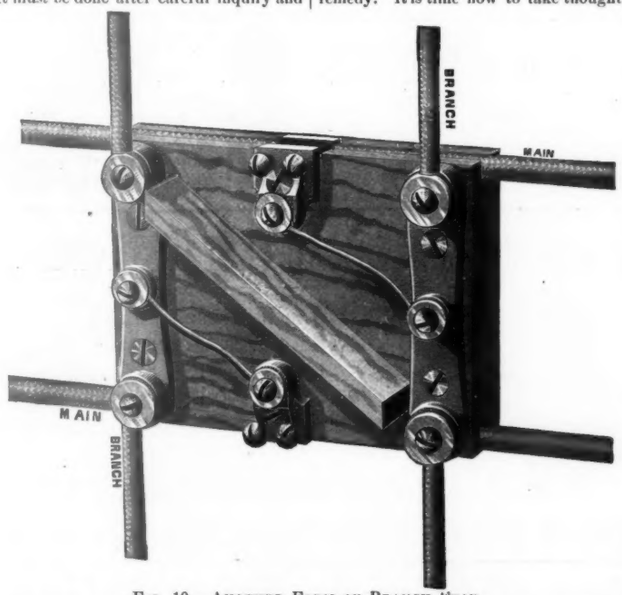


FIG. 10.—ANOTHER FORM OF BRANCH FUSE.

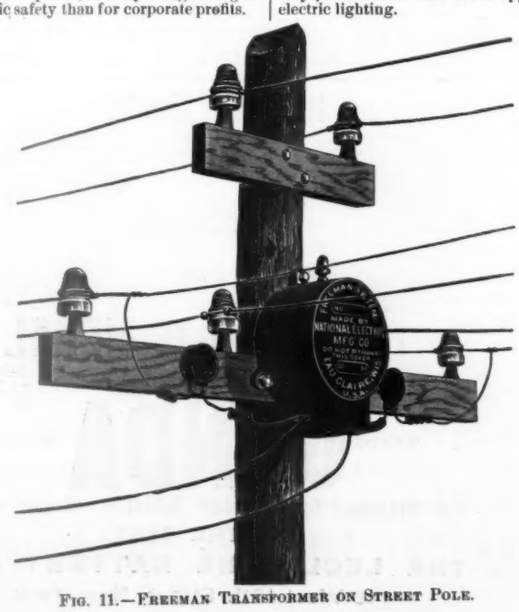


FIG. 11.—FREEMAN TRANSFORMER ON STREET POLE.

An Enterprising Railway Company.

Not content with affording travelers by the limited express every comfort and luxury, in the way of electric light, baths, barber shop, library, smoking-rooms, café and bedrooms, as well as a ladies' maid for patrons of the gentle sex, the Pennsylvania Railroad Company have added new features in giving business men the advantage of being able to keep abreast of the fluctuations of the stock market and weather reports. Noted, as it is, for its famous "fliers," the Pennsylvania Railroad Company cannot make its trains move so fast but that the swift steps of the electric current can overtake them at a bound. Hence, it is but natural that the rise and fall of stocks should be made accessible to the traveling business man, and that he and others interested should be informed of the character of the weather which may await them at their journey's end, so that they may attire themselves accordingly. But weather reports are of vast usefulness to the business community, and ofttimes a knowledge of them is of great moment and value to the traveler.

To cap the climax of utility, however, the company has just come to the front with what is sure to prove a real boon and blessing to the busy brain whose idle hours on the rushing train have hitherto been but a season of impatient annoyance.

Though electricity does not enter into the new feature, it deserves more than a mere mention. The Pennsylvania Railroad Company will introduce, on February 1, an expert stenographer and typewriter on each of the "Limited" trains between New York and Pittsburgh, to take the dictation, and transcribe on the type-writer the correspondence of the passengers who desire to avail themselves of his services. A business or professional man thus can attend to correspondence *en route*, and save much time, the letters being mailed directly from the train when finished. He can dictate matter of any kind: The lawyer his brief; the clergyman his sermon; the author, the flying thoughts which otherwise would be lost; the promoter going to meet capitalists, can formulate his prospectus at his leisure, and so through an almost indefinite category of the daily wants and contingencies incident to everyone while "on the road." This feature is bound to at once spring into great favor, and we will be surprised, if in a few weeks, one stenographer and type-writer will be found sufficient. In that event, the phonograph might be called into requisition, and several type-writers for transcribing the records.

Directors Elected.

The Edison Electric Light Company, of Philadelphia, has elected the following directors: Samuel B. Huey, D. S. Lindsay, John Lucas, L. D. Brown, Arthur Colburn, B. K. Jamison, Amos R. Little, Charles M. Swain, H. Blake Tyler, William T. Tiers, Joseph P. Ord. The officers of the corporation were elected as follows: President, L. D. Brown; vice-president, B. K. Jamison; secretary and treasurer, A. V. Sloan; solicitor, Samuel B. Huey; supervising engineer and general manager, William D. Marks.

Large Factory Facilities.

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Correspondence addressed to "ELECTRIC," care of Editor ELECTRICAL REVIEW, will receive prompt attention.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JANUARY 28, 1889.

420,070 Electric detecting apparatus for coin-actuated boxes; William J. Howey, New York, N. Y.

420,077 Incandescent lamp socket; Hermann Lemp, Hartford, Conn., assignor to the Schuyler Electric Company, of Conn.

420,079 420,080 Electric reciprocating tool; Harry N. Marvin, Syracuse, N. Y.

420,091 Testing apparatus for telephone exchange switches; Joseph J. O'Connell, Chicago, Ill.

420,096 Lightning arrester; Chas. A. Pfluger, Chicago, Ill., assignor to David P. Perry, same place.

420,101 Conduit for electric street railways; Jesse W. Rens, Boston, Mass.

420,102 Telegraphic transmission of index movements; Felix Richards, Paris, France, assignor to the Societe Richard Freres, same place.

420,109 Electric arc lamp; Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place.

420,117 Electric motor and regulator therefor; Elmer A. Sperry, Chicago, Ill.

420,138 Regulator for dynamos; James J. Wood, Brooklyn, N. Y.

420,171 Insulating casing; John A. Seely, New York, N. Y.

420,173 Electric fire alarm system; John Speicher, Jersey City, assignor by direct and mesne assignments to the Newark District Telegraph Company, Newark, N. J.

420,183 Telephone exchange apparatus; Franklin G. Beach, Chicago, Ill., and Frank B. Cook, Toledo, Ohio.

420,198 Automatic safety cut-off for electric circuits; Geo. M. Guenant, New York, N. Y., assignor to himself and H. A. Wise Wood, same place.

420,214 Electric meter; Walter F. Smith, Philadelphia, Pa., assignor to the United Electric Improvement Company, Gloucester City, N. J.

420,234 Plate for secondary batteries; Geo. A. Johnson, Boston, Mass.

420,240 Printing telegraph; James F. McLaughlin, Philadelphia, Pa.

420,255 Electric signal; John D. Taylor, Piketon, Ohio.

420,292 Light holder; James F. Barrett, Meadville, Pa., assignor of one-half to Farman T. Fish, same place.

420,358 Printing instrument or apparatus for telegraphic or other uses; James H. Rogers, Bladensbury, Md., assignor to the Visual Synchronism Company, of West Virginia.

420,370 Incandescent lamp socket; Merle J. Wightman, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

420,384 Electrical communicating system; Alfred G. Holcombe, New York, N. Y., assignor to the Electric Signal Manufacturing Company, same place.

420,393 Telegraph apparatus; Ebenezer B. Shafer, New York, N. Y.

420,396 Electric transformer; Elihu Thomson, Lynn, Mass.

420,398 Governor for dynamos or motors; Addison G. Waterhouse, Hartford, Conn., assignor by mesne assignments to the Schuyler Electric Company, of Connecticut.

420,422 Current direction indicator; Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place.

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EXAMINATION OF INSPECTORS.

AN OPEN COMPETITIVE EXAMINATION of applicants for appointment under the Board of Electrical Control as Inspectors of Electrical Conductors and Inspectors of Underground Construction, will be held at Room 21, Cooper Union, New York City, on Tuesday, February 11, commencing at 10 o'clock, A. M.

Also at the same hour and place applicants for appointment as Interpreters. Candidates must be residents of the State of New York. Blank applications and other information may be had by addressing the Secretary of the Civil Service Commission, Albany, N. Y.

JOHN B. RILEY,
Chief Examiner.

Albany, N. Y., Jan. 30, 1890.

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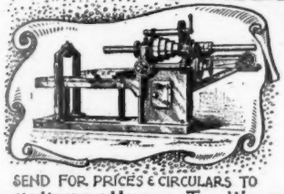
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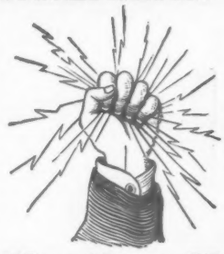
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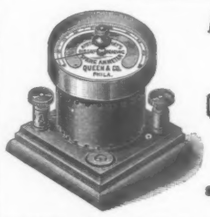
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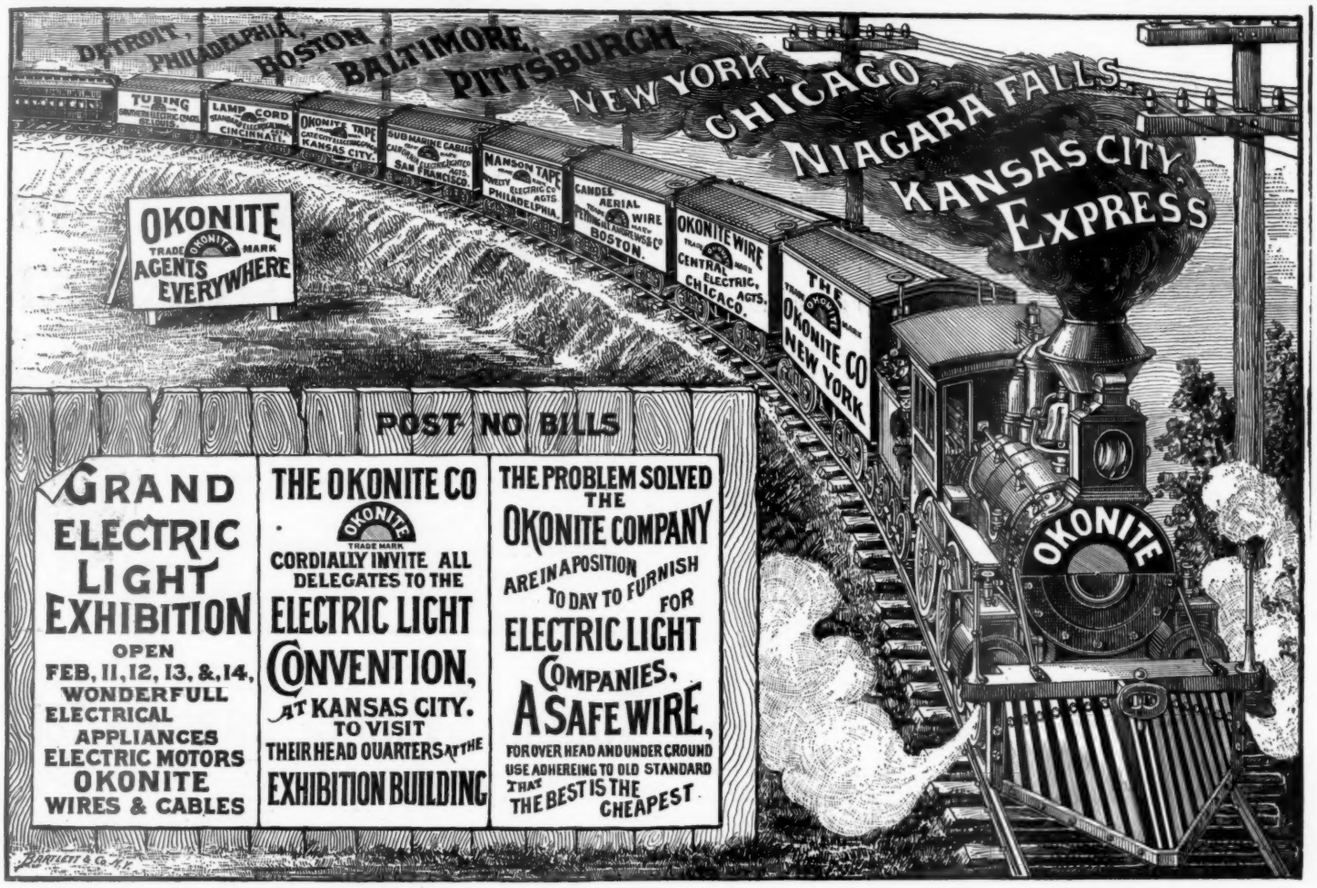
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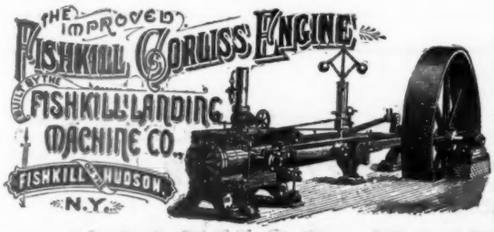

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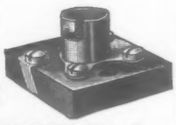

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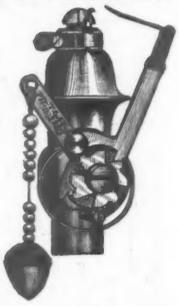

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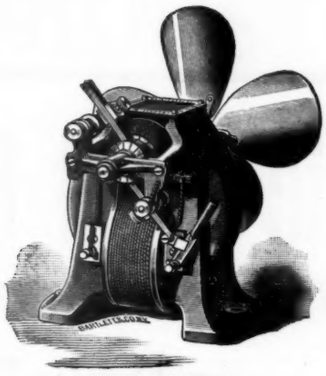

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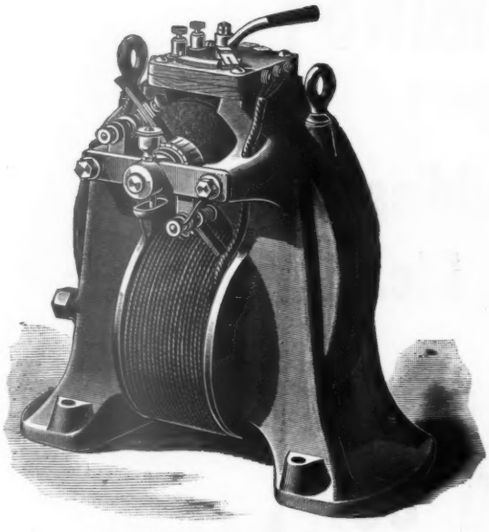

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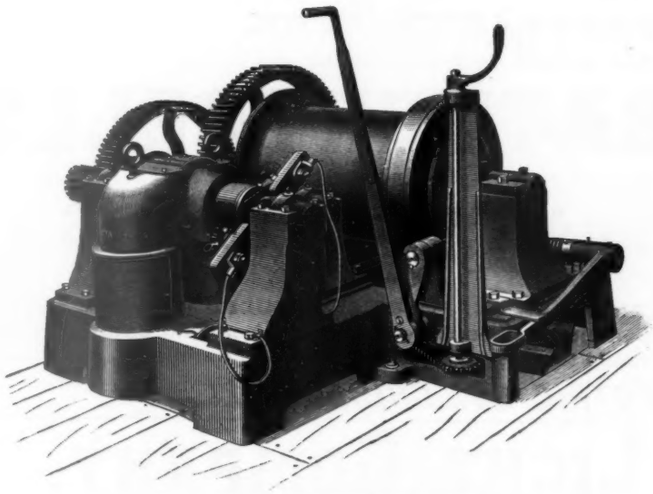

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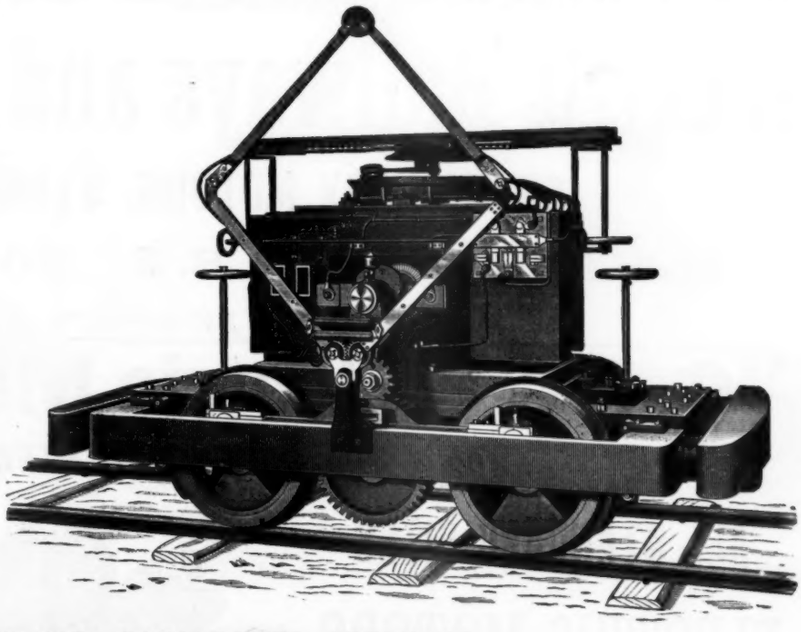

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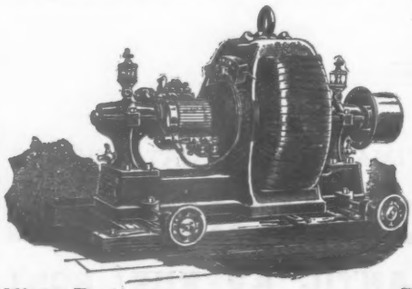

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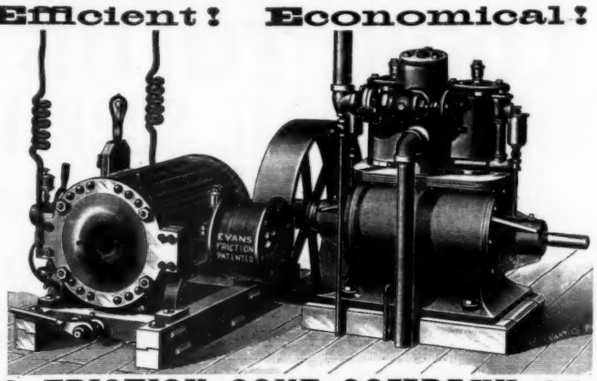

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C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	830
C	.....	10	.....	.....	6.3	1½		830
C	.....	.....	.....	25	8.0	2		830
E	16	.....	.....	.....	12.0	2⅜		780
E	.....	20	.....	.....	12.5	2⅜		780
E	.....	.....	26	.....	13.0	2⅜		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
G	.....	.....	.....	50	16.0	3		990
G	28	.....	.....	.....	21.0	4½		1,360

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Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
C	.....	.....	45	.....	21.0	4		1,360
C	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
I	.....	.....	83	.....	38.0	8		2,290
K	64	.....	.....	.....	46.5	10		2,770
K	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,300

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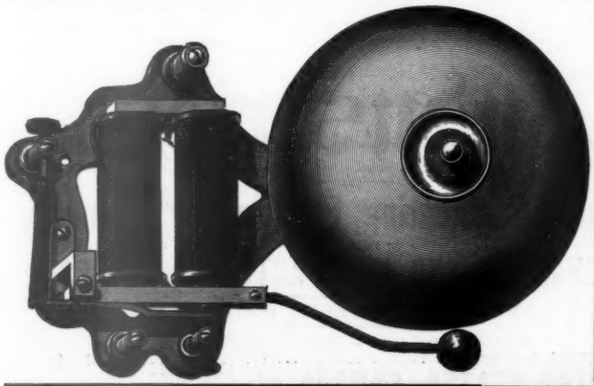

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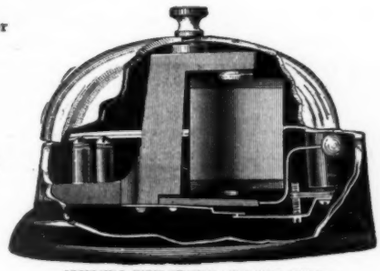

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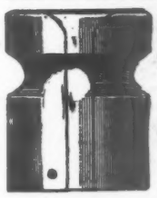

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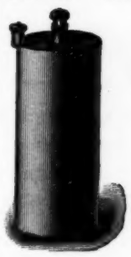

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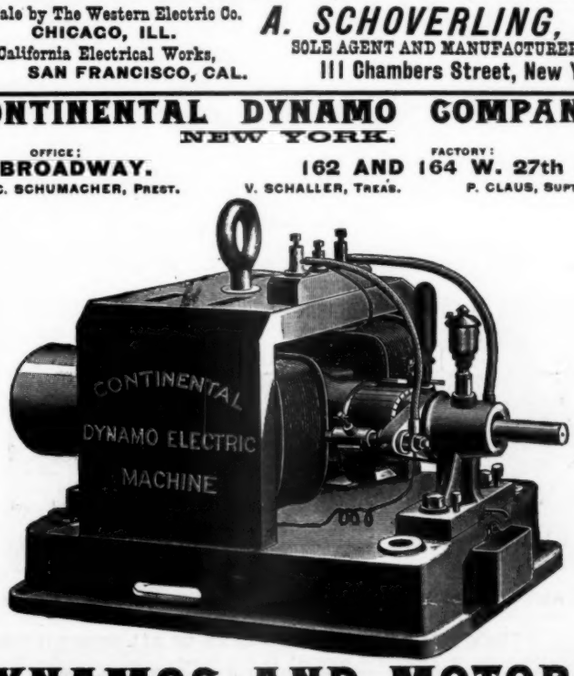

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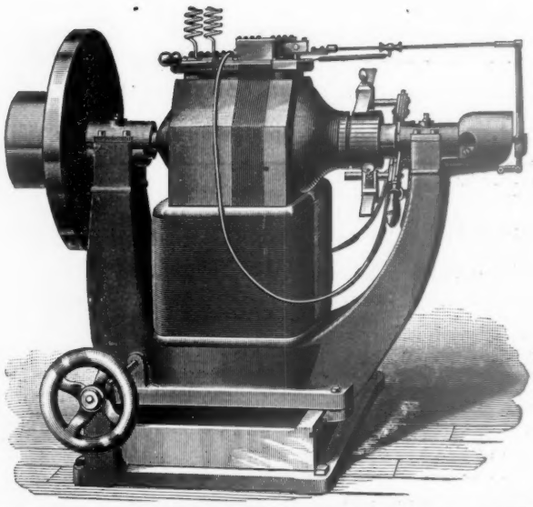

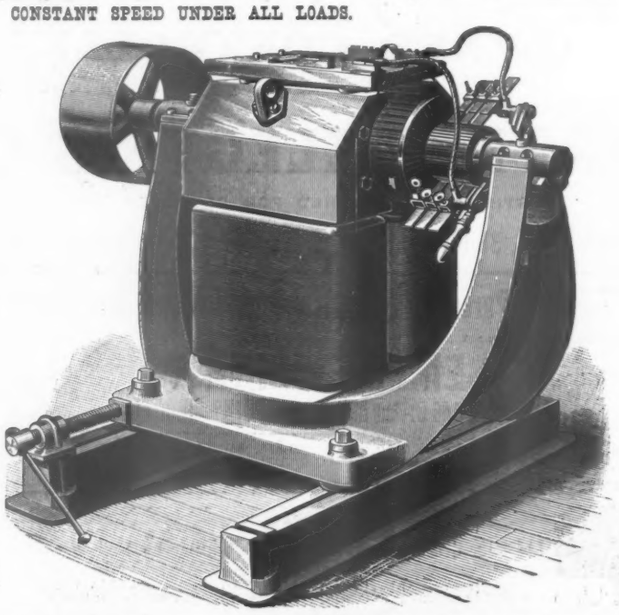

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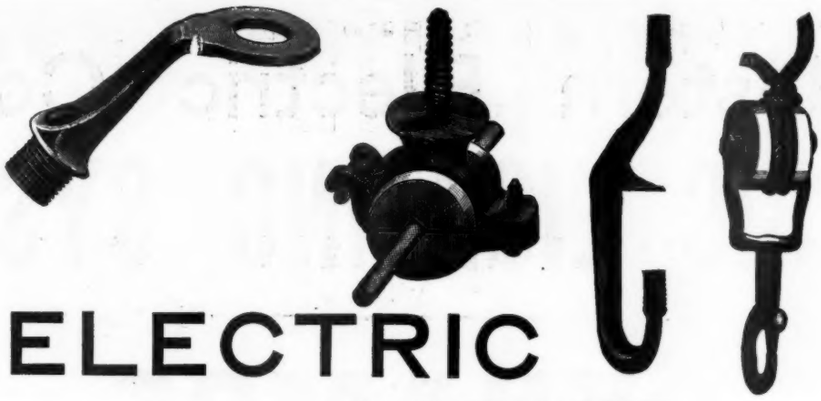

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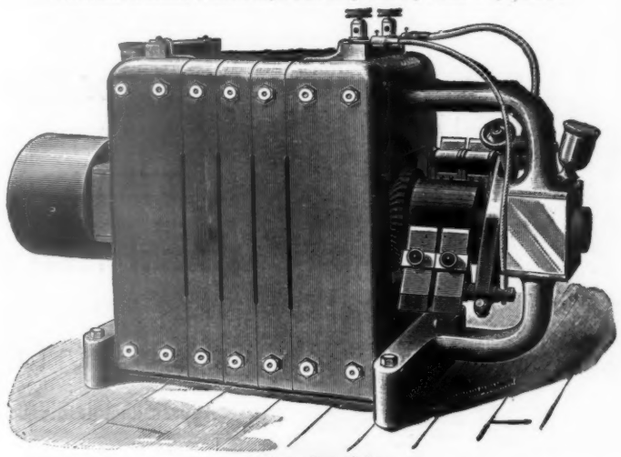

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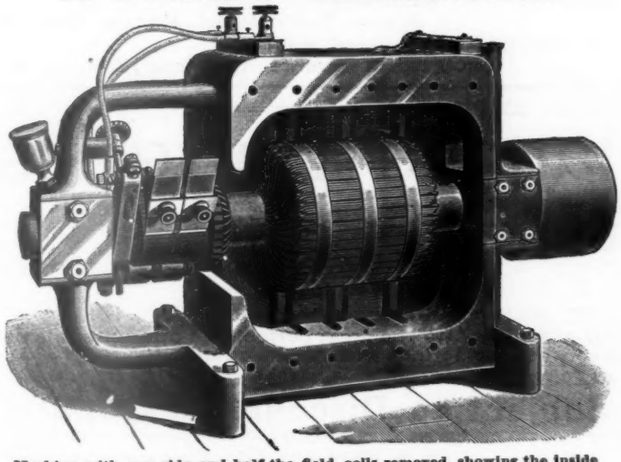

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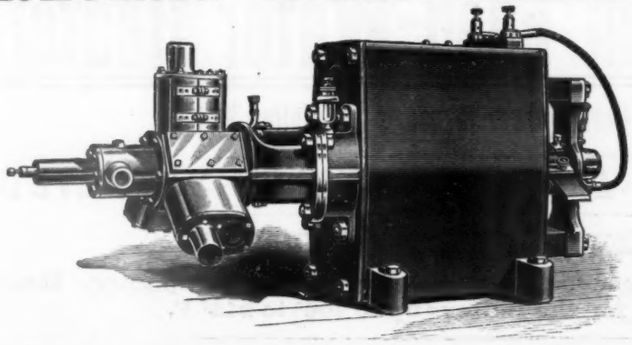

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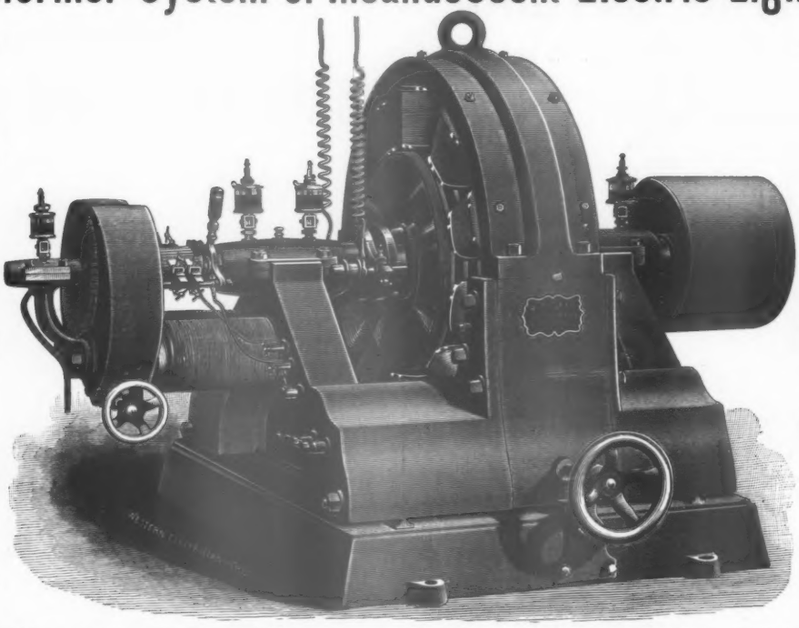

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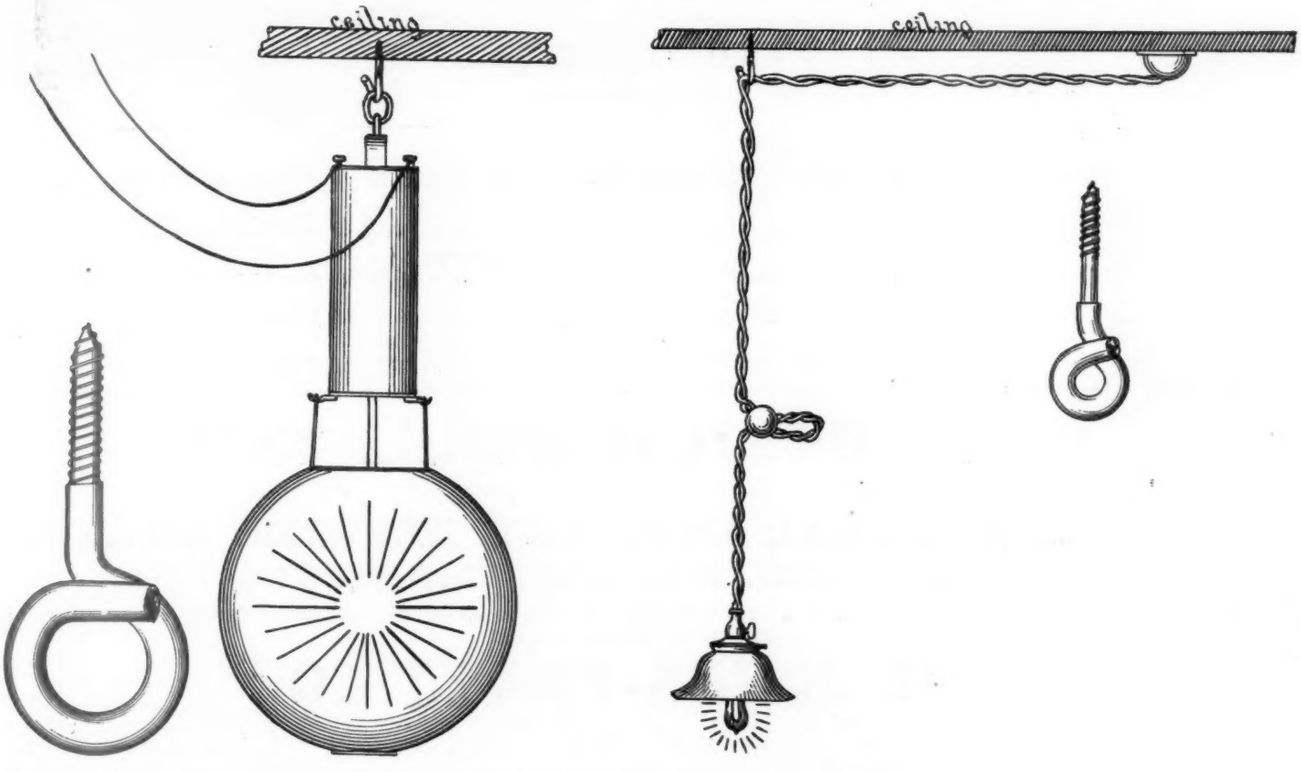

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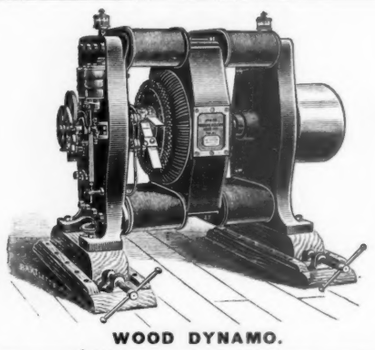

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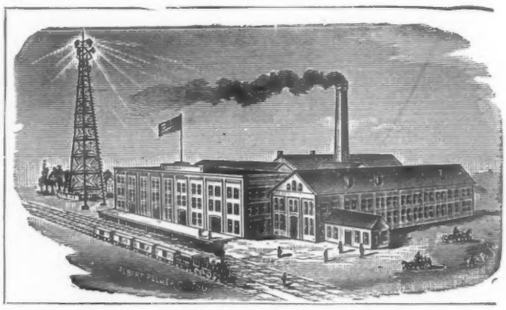

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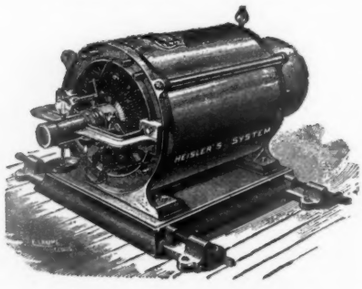

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